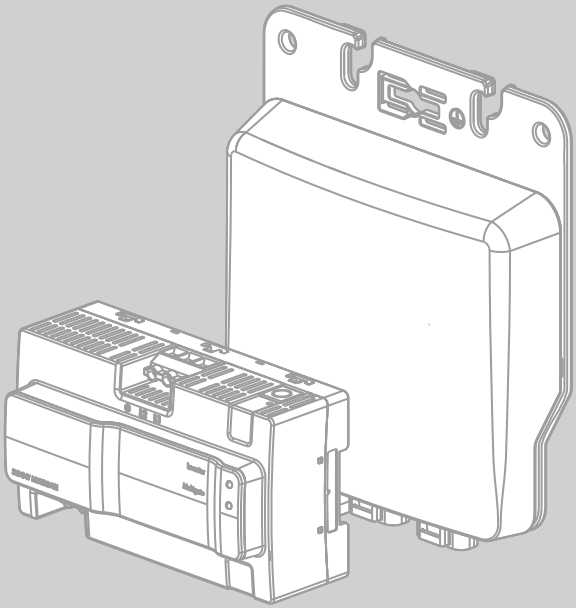
Micro Inverter with Communication Unit

SUNNY BOY 240-US
SUNNY MULTIGATE-US

Installation Manual



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CA US

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the system consisting of the following products:

- micro inverter model SB 240-US-10
- communication unit model Multigate-US-10

This manual must be followed during installation and maintenance.

The products are designed and tested according to international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the products. To reduce the risk of personal injury and to ensure the safe installation and operation of the products, you must carefully read and follow all instructions, cautions and warnings in this manual.

Warnings in this document

A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment or personal injury.

Symbol	Description
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE is used to address practices not related to personal injury.

Warnings on the products

The following symbols are used as product markings with the following meanings.

Symbol	Description
	Warning regarding dangerous voltage The product works with high voltages. All work on the product must only be performed as described in the documentation of the product.
	Beware of hot surface The product can become hot during operation. Do not touch the product during operation.
	Observe the operating instructions Read the documentation of the product before working on it. Follow all safety precautions and instructions as described in the documentation.

General Warnings

⚠ WARNING

All electrical installations must be done in accordance with the local and *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1. This document does not and is not intended to replace any local, state, provincial, federal or national laws, regulation or codes applicable to the installation and use of the product, including without limitation applicable electrical safety codes. All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation. SMA assumes no responsibility for the compliance or noncompliance with such laws or codes in connection with the installation of the product.

The product contains no user-serviceable parts. For all repair and maintenance, always return the unit to an authorized SMA Service Center.

Before installing or using the product, read all of the instructions, cautions, and warnings in this manual.

Before connecting the product to the electrical utility grid, contact the local utility company. This connection must be made only by qualified personnel.

Wiring of the product must be made by qualified personnel only.

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1 Information on this Document

Validity

This document is valid for the following device types:

- SB 240-US-10 (Sunny Boy 240-US)
- Multigate-US-10 (Sunny Multigate-US)

Target Group

This document is intended for qualified persons. Only personnel with the appropriate skills are allowed to perform the tasks set forth in this document (see Section 2.2 "Skills of Qualified Persons", page 14).

Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
Micro Inverters in Sunny Portal	User manual
Sunny Explorer	User manual

Symbol

Symbol	Explanation
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates an essential requirement for achieving a specific goal
☑	Desired result
✖	A problem that could occur

Nomenclature

Full designation	Designation in this document
SMA America Production, LLC	SMA
SMA Solar Technology Canada Inc.	SMA
SMA Speedwire	Speedwire
Sunny Boy 240-US*	Sunny Boy, inverter, micro inverter*
Sunny Multigate-US	Sunny Multigate, communication unit
Inverter which is located at the beginning of the PV system and directly connected to the Sunny Multigate via the AC cable	First inverter
Inverter which is located at the end of the PV system and not directly connected to the Sunny Multigate	Last inverter

* The terms "Sunny Boy", "Sunny Boy 240-US", "micro inverter" and "inverter" are synonymous in this document. For simplicity, the general term "inverter" is often used.

2 Safety

2.1 Intended Use

Sunny Boy 240-US

The Sunny Boy is a micro inverter for PV systems that converts the direct current from a PV module into grid-compliant alternating current. The alternating current generated is fed into the utility grid via the Sunny Multigate-US communication unit.

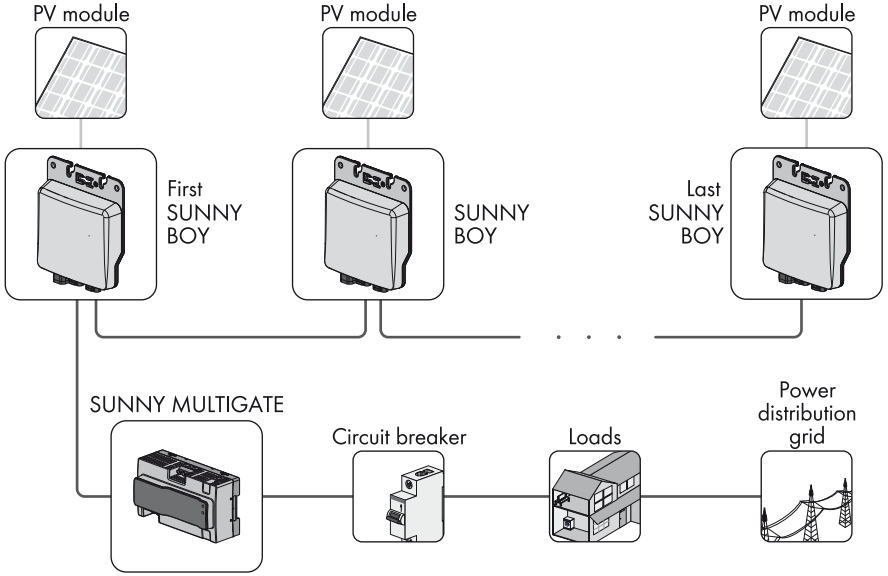


Figure 1: Design of a PV system with Sunny Boy 240-US and Sunny Multigate-US

The Sunny Boy is suitable for indoor and outdoor use.

The Sunny Boy may only be connected to one PV module. The PV module used must be compatible for use with the Sunny Boy. The Sunny Boy must be operated with the Sunny Multigate.

All components must remain within their permitted operating ranges at all times.

The product may only be used in countries for which it is approved or released by SMA and the grid operator.

For safety reasons, it is forbidden to modify the product or install components that are not explicitly recommended for this product or distributed by SMA.

Use the Sunny Boy in accordance with the information provided in the enclosed documentation only. Any other use can result in personal injury or property damage.

- Do not connect any loads between the Sunny Boy and the Sunny Multigate.

- The grounding conductor of the AC cable from the inverter must be connected to the Sunny Multigate.
- The equipment grounding conductor must be connected to the equipotential bonding of the AC distribution board.
- Do not open the lid of the Sunny Boy.
- Only mount the Sunny Boy on the framework mounted on the roof directly under the PV modules or on the wall.
- Do not mount the Sunny Boy directly on the module frame.
- Do not mount the Sunny Boy in areas where flammable gases may occur.
- Do not mount the Sunny Boy in areas containing highly flammable materials.
- Do not mount the Sunny Boy in potentially explosive atmospheres.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

Sunny Multigate-US

The Sunny Multigate is a communication unit and forms the electrical connection point of the PV system with a maximum of twelve micro inverters to the utility grid. The Sunny Multigate is connected between the micro inverters and the utility grid to feed the alternating current converted by the micro inverters collectively into the utility grid.

The Sunny Multigate is designed for split-phase operation only. The Sunny Multigate must be operated in conjunction with SMA micro inverters of type SB 240-US-10.

The Sunny Multigate must always be installed in a dust-tight and water-tight industrial enclosure complying with the fire protection class 5VA and pollution degree 3. For indoor use, an industrial enclosure Type 1 with back panel complying with UL50 is required. For outdoor use, an industrial enclosure Type 3 with back panel complying with UL50E is required.

The product may only be used in countries for which it is approved or released by SMA and the grid operator.

For safety reasons, it is forbidden to modify the product or install components that are not explicitly recommended for this product or distributed by SMA.

Only use the Sunny Multigate in accordance with the information provided in the enclosed documentation. Any other use can result in personal injury or property damage.

- A maximum of twelve micro inverters can be connected to the Sunny Multigate.
- No loads may be connected between the Sunny Multigate and the circuit breaker.
- The grounding conductor of the AC cable from the inverter must be connected to the Sunny Multigate.
- The grounding conductor of the Sunny Multigate must be connected to the equipotential bonding of the AC distribution board.
- The Sunny Multigate must not be opened.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Skills of Qualified Persons

The tasks described in this document must be performed by qualified persons only. Qualified persons must have the following skills:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of the applicable standards and guidelines
- Knowledge of and adherence to this document and all safety precautions

2.3 Safety Precautions

This section contains safety precautions that must be observed at all times when working on or with the product.

To prevent personal injury or property damage and to ensure long-term operation of the product, read this section carefully and follow all safety precautions at all times.

⚠ DANGER

Danger of electric shock due to high voltages

In the live components of the inverter and the Sunny Multigate, high voltages are present that can cause fatal electric shocks if touched.

- Do not open the inverter.
- Do not open the Sunny Multigate.
- Do not touch any live components of the inverter.
- Do not touch any live components of the Sunny Multigate.
- Prior to performing any work on the inverter, disconnect it from any voltage sources as described in this document (see Section 9).
- Prior to performing any work on the Sunny Multigate, disconnect it from any voltage sources as described in this document (see Section 10).
- Observe the safety messages on the inverter and the Sunny Multigate.

⚠ DANGER

Risk of electric shock due to ground fault

If a ground fault has occurred, parts of the system that are supposedly grounded may in fact be live. Death or serious injuries can occur from contact with live components.

- Prior to touching any components, always disconnect the inverter from any voltage sources as described in this document (see Section 9).
- Prior to touching any components, always disconnect the Sunny Multigate from any voltage sources as described in this document (see Section 10).

⚠ DANGER

Risk of electric shock due to damaged devices

Operating a damaged inverter or Sunny Multigate can lead to hazardous situations that result in death or serious injuries due to electric shock.

- Only operate the inverter and the Sunny Multigate provided that they are in safe and full working order.
- Regularly check for visible damage.

⚠ WARNING

Risk of burns from hot surfaces

The surfaces of the inverter and the Sunny Multigate can get very hot. Touching the surface can result in burns.

- Mount the inverter in such a way that it cannot be touched inadvertently.
- Do not touch hot surfaces.
- Wait ten minutes for the surface to cool sufficiently before performing any work on the inverter.
- Observe the safety messages on the inverter and the Sunny Multigate.

NOTICE

Damage to the inverter due to moisture and dust intrusion

Dust or moisture intrusion can damage the inverter and impair its functionality.

- Seal all inverter pin connectors with the appropriate plugs or protective caps.

NOTICE

Damage to the Sunny Multigate from moisture and dust intrusion

Dust or moisture intrusion can damage the Sunny Multigate and impair its functionality.
The Sunny Multigate must always be installed in an industrial enclosure complying with UL50E. This ensures that the Sunny Multigate is protected against dust and moisture and is suitable for indoor and outdoor operation.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

3 Scope of Delivery

Check the scope of delivery for completeness and any external visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

Sunny Boy

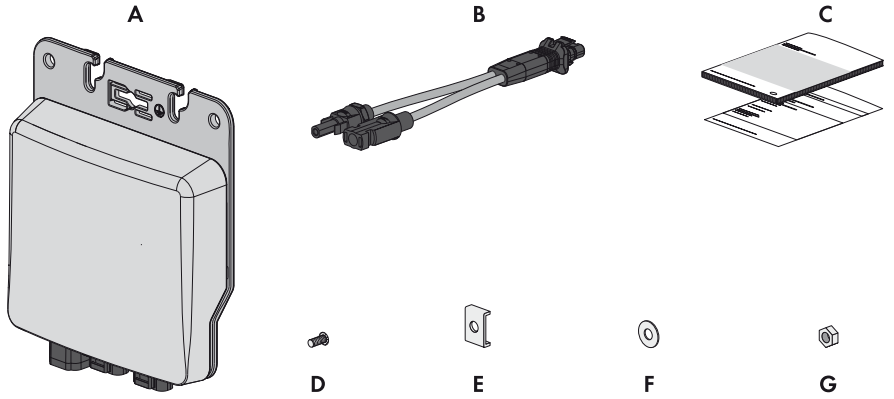


Figure 2: Elements included in the scope of delivery of the Sunny Boy

Item	Number	Designation
A	1	Sunny Boy
B	1	DC plug with two DC connectors*
C	1	Supplementary sheet for Sunny Boy Installation manual for Sunny Boy and Sunny Multigate, mounting overview**
D	1	Grounding bolt
E	1	Clamping bracket for equipment grounding
F	2	Washer for equipment grounding
G	2	Hexagon nut for equipment grounding

* The DC connectors illustrated may deviate from your order (for additional DC plugs, see Section 14 Accessories).

** The installation manual and mounting overview are only included in the delivery if you receive six inverters in one package. You will in any case receive the installation manual and mounting overview for Sunny Boy and Sunny Multigate with the delivery of the Sunny Multigate.

Sunny Multigate-US

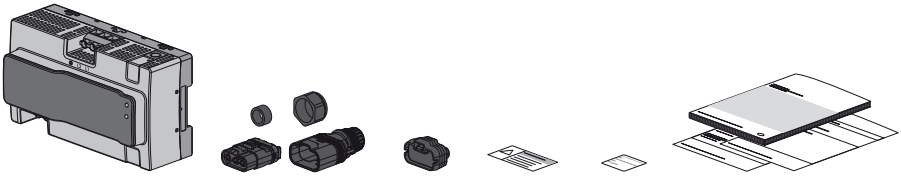


Figure 3: Elements included in the scope of delivery of the Sunny Multigate

Item	Number	Designation
A	1	Sunny Multigate
B	1	AC field plug: insulator, enclosure, seal, nut
C	1	Protective cap for the unused AC pin connector of the last inverter*
D	1	Warning labels for attaching to the industrial enclosure
E	1	Sticker with Registration ID (RID) and Identification Key (PIC) for the registration in Sunny Portal**
F	1	Installation manual for Sunny Boy and Sunny Multigate, mounting overview, Production Test Report

* Last inverter: The inverter that is located at the end of the PV system and not directly connected to the Sunny Multigate but only to one other inverter, is called the "last inverter" in this document. An AC pin connector remains unused on the last inverter and must be closed with the protective cap.

** Keep this sticker with your access data for the registration in Sunny Portal for later reference. You can also find your access data on the type label of the Sunny Multigate.

AC Cable

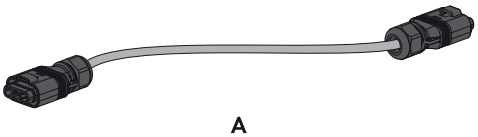


Figure 4: Element included in the scope of delivery of the AC cable

Item	Number	Designation
A	1	AC cable with two connectors

4 Product Description

4.1 Sunny Boy

The Sunny Boy is a micro inverter for PV systems that converts the direct current from a PV module into grid-compliant alternating current. The alternating current generated is fed into the utility grid via the Sunny Multigate.

Symbols on the Inverter

Symbol	Description
	Equipment grounding terminal

4.2 Sunny Multigate

The Sunny Multigate is a communication unit and forms the electrical connection point of the PV system with a maximum of twelve micro inverters to the utility grid. The Sunny Multigate is connected between the micro inverters and the utility grid to feed the alternating current converted by the micro inverters collectively into the utility grid.

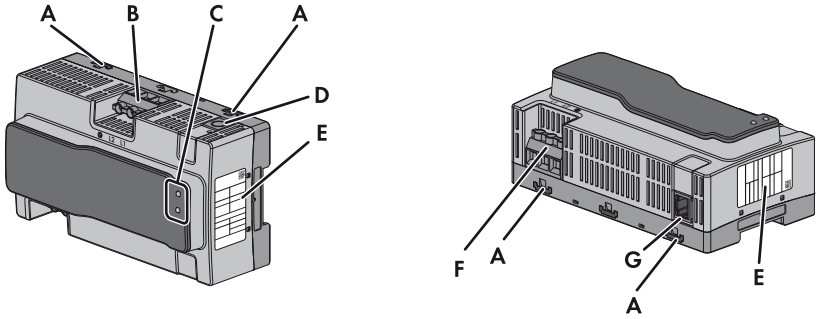


Figure 5: Design of the Sunny Multigate

Item	Designation
A	Press-out lugs for mounting with screws
B	Screw terminal for AC input (inverter) Labeling: Inverter
C	LEDs
D	Interface for optional communication
E	Type label

Item	Designation
F	Screw terminal for AC output (utility grid) Labeling: Grid
G	Pin connector for connecting network cable

The Sunny Multigate is equipped with two LEDs. The upper LED indicates the operating state of the inverter. The lower LED indicates the operating state of the Sunny Multigate.

Depending on the operating state, the LEDs are glowing green, red or orange, or are off (see Section 11.1 "LED Signals on the Sunny Multigate", page 63).

The transmission and transfer of data with the connected micro inverters takes place via Powerline Communication. Data transmission from the Sunny Multigate to external devices takes place via Speedwire.

4.3 Type Labels and Stickers

Sunny Boy

The type label provides a unique identification of the inverter. The type label is located on the right-hand and left-hand sides of the enclosure. On the left-hand side of the enclosure, you will find the warnings and safety precautions. On the right-hand side of the enclosure, you will find the product-specific data.

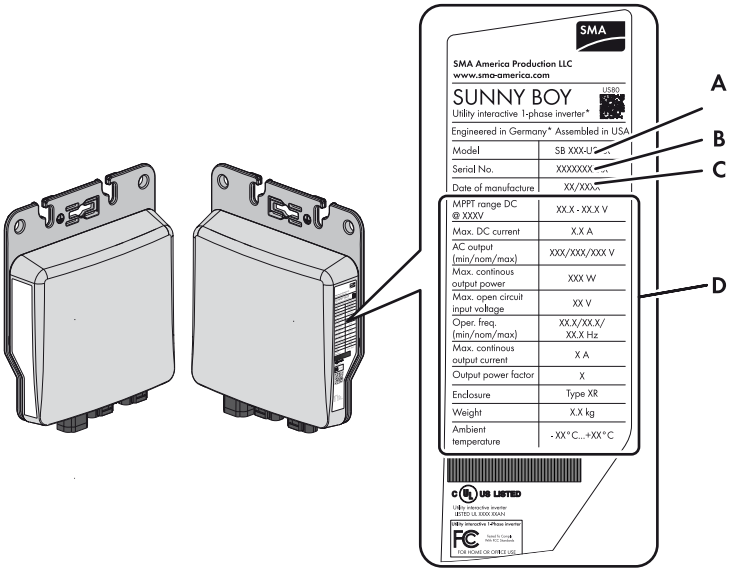


Figure 6: Design of the Sunny Boy type label

Item	Designation
A	Inverter device type
B	Inverter serial number
C	Inverter manufacture date (month/year)
D	Device-specific characteristics

The information on the type label is required for both safe operation of the inverter and for customer support from the SMA Service Line. The type label must remain permanently affixed to the inverter.

Label with Inverter Serial Number

A type label with the serial number of the inverter is located at the back of the Sunny Boy.

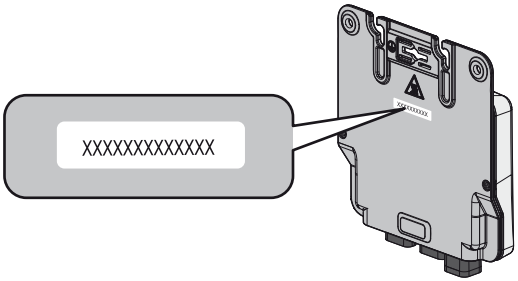


Figure 7: Label with serial number on the rear side of the inverter

This label is detachable. To enable clear identification of the inverters of a PV system, e.g. in the event of error, this label can be applied to the enclosed mounting overview.

Sunny Multigate

The type label provides a clear identification of the Sunny Multigate. The type label is located on the right-hand side of the enclosure.

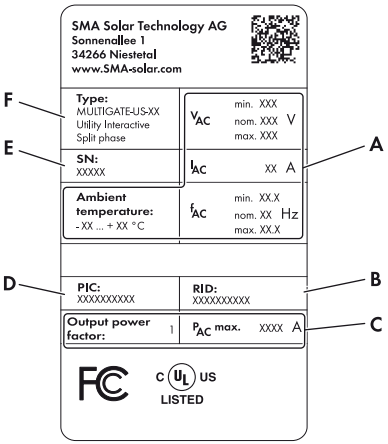


Figure 8: Layout of the Sunny Multigate type label

Item	Designation
A	Device-specific characteristics
B	Registration ID (RID) for registration in Sunny Portal
C	Device-specific characteristics

Item	Designation
D	Identification key (PIC) for registration in Sunny Portal
E	Serial number of the Sunny Multigate
F	Device type of the Sunny Multigate

You will require the information on the type label to use the Sunny Multigate safely and for customer support from the SMA Service Line. The type label must be permanently affixed to the Sunny Multigate.

Symbols on the Type Labels

Symbol	Description
c UL us LISTED	UL1741 is the standard applied by Underwriters Laboratories to the product to certify that it meets the requirements of the *National Electrical Code*®, the *Canadian Electrical Code*® CSA C22.1 and IEEE-929-2000. IEEE 929-2000 provides recommendations regarding the proper equipment and functionality necessary to ensure compatible operation when power generation is connected to the utility grid.
FC	The product fulfills the requirements of the applicable FCC standard.

4.4 Communication

Communication between Inverter and Sunny Multigate

The inverter is connected to the Sunny Multigate via the AC cable. The communication and data transmission between the Sunny Multigate and the inverters takes place via a Powerline interface.

Communication between Sunny Multigate and Other Communication Products

Communication between the Sunny Multigate and other SMA communication products (e.g. Sunny Portal, Sunny Explorer) takes place via Speedwire/Webconnect. Speedwire is an Ethernet-based type of communication. You can connect the inverter to your local network via Speedwire. Webconnect enables data exchange between Sunny Multigate and Sunny Portal. In order to establish a connection to Sunny Portal, the Sunny Multigate must be connected to a router with Internet connection and be integrated into the local network. To enable data exchange between Sunny Multigate and Sunny Portal, you must register the PV system in Sunny Portal (see Section 8.2). If you do not want to use the Webconnect function, you can deactivate it in the Sunny Explorer (see Section 8.6 "Deactivating the Webconnect Function", page 58).

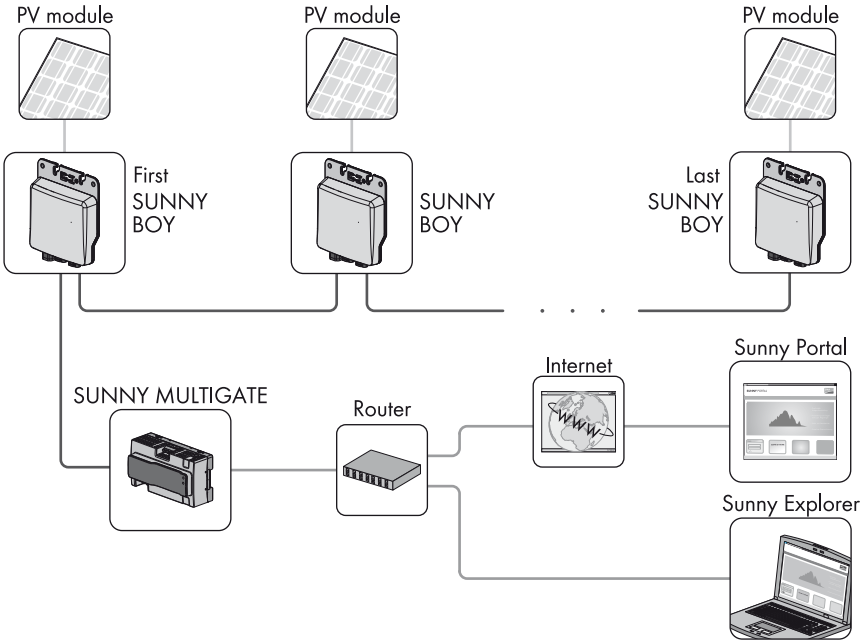


Figure 9: Example of a PV system with micro inverters and Sunny Multigate with communication via Speedwire/Webconnect

5 Mounting

5.1 Requirements for Mounting the Inverter

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter in areas where flammable gases may occur.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

⚠ WARNING

Risk of burns from hot surfaces

The surface of the inverter can get very hot. Touching the surface can result in burns.

- Mount the inverter so that it cannot be touched inadvertently.
- Do not touch hot surfaces.
- Wait ten minutes for the surface to cool down before performing any work on the inverter.
- Observe the safety messages on the inverter.

☐ The mounting location must be inaccessible to children.

☐ The inverter must be mounted on the framework underneath the PV modules on the roof or on a solid building ground (e.g. concrete, brickwork). In living areas, make sure that the building ground is not made of plasterboard or similar. When in use, the inverter makes noises which can be perceived as a nuisance in a living area.

☐ When mounting on the framework, the mounting position should preferably be in the center of the PV module. This will ensure a longer electrical endurance of the inverter.

☐ The mounting location must be suitable for the weight and dimensions of the inverter (see Section 13.1 "Sunny Boy 240-US", page 75).

☐ The mounting location should not be exposed to direct solar irradiation. Direct solar irradiation can increase the operating temperature of the inverter. As a result, the inverter reduces its power output.

☐ The ambient temperature must be between –40°F and +149°F (–40°C and +65°C). This ensures optimal operation of the inverter.

Dimensions for mounting:

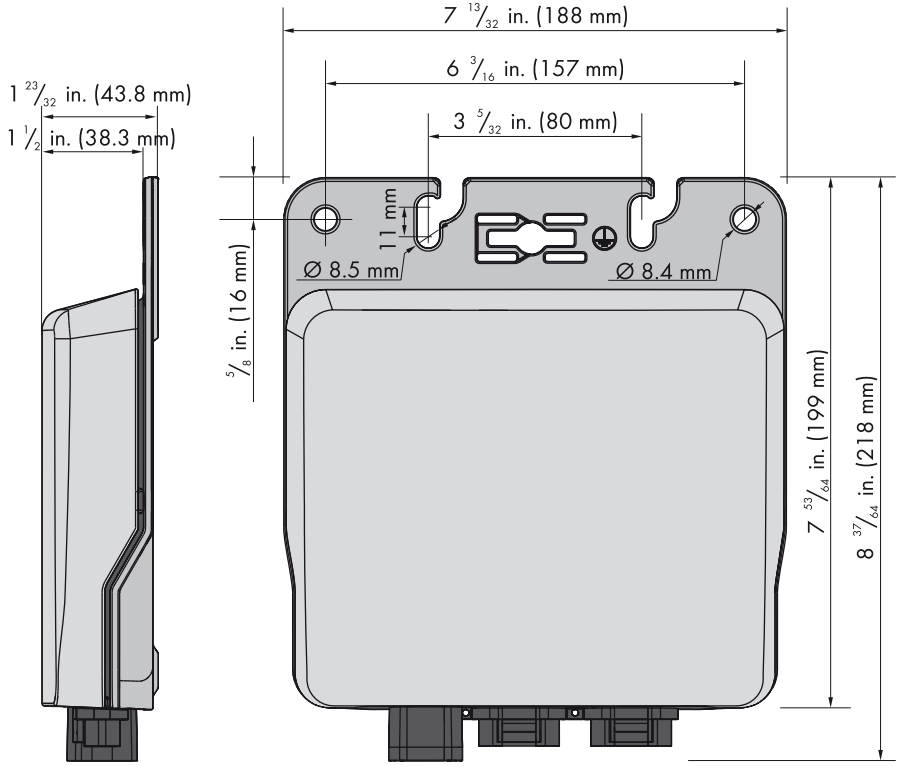


Figure 10: Dimensions of the inverter and the drill holes for mounting

Recommended clearances:

Depending on the length of the AC cable, observe the following clearances:

- ☐ When using an AC cable of length $4\,^{19}/_{32}$ ft. (1.40 m):
  min. 2 in. (50 mm) to max. $3\,^{39}/_{64}$ ft. (1.10 m)
- ☐ When using an AC cable of length $6\,^{9}/_{16}$ ft. (2.0 m):
  min. 2 in. (50 mm) to max. $5\,^{37}/_{64}$ ft. (1.70 m)
- ☐ Observe recommended clearances to the inverters or other objects.

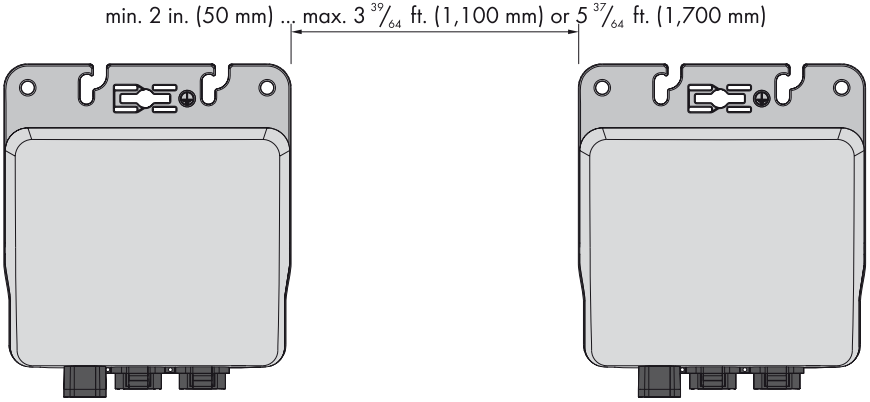


Figure 11: Recommended clearances

Minimum clearance between inverter and PV module bottom side:

NOTICE

Damage to the PV module due to insufficient clearance between the inverter and the PV module bottom side

For roof mounting, the clearance from the inverter to the PV module bottom side must be at least $1\,^{3}/_{16}$ in. (30 mm). As a result, you prevent the grounding bolt from damaging the PV module.

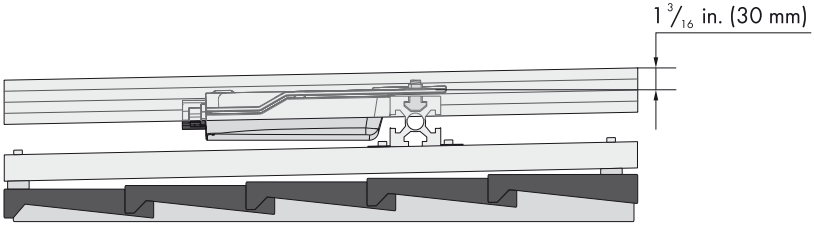


Figure 12: Minimum clearance of the inverter to the PV module bottom side

Permitted Mounting Position:

⚠ DANGER

Electric shock due to ingress of moisture

- During mounting, make sure that the connection area of the inverter remains dry.

  As soon as the connector and the protective cap are plugged in, the connection area will be protected from moisture ingress. As a result, the inverter complies with Type 3R.

5.2 Mounting the Inverter

5.2.1 Mounting the Inverter on the Roof

⚠ WARNING

Risk of death or serious injury when working on the roof

There is a risk of falling or slipping when working on the rooftop. Observe the following instructions when working on the rooftop:

- Observe the applicable accident prevention regulations for work on rooftops.
- Before walking on the roof, check and ensure the load bearing capacity of all parts subjected to load.
- According to the accident prevention regulations, a safety harness must be worn or a safety scaffold must be used.
- Use an anti-fall guard.

When mounting the inverter on the roof underneath the PV modules, proceed as follows.

You can mount the inverter with the back panel or with the enclosure lid to the roof. SMA recommends mounting the inverter with the enclosure lid to the roof to ensure better heat dissipation. Observe the minimum clearance of the inverter to the PV module.

Information on the illustrations in this section

The illustrations show the recommended mounting option for the inverter with the lid to the roof. The procedure for mounting the inverter with the back panel to the building ground is identical and is not depicted in the illustrations in this section.

Position of the inverter

In order to ensure optimum operation and long electrical endurance of the inverter, install each inverter under the center of the respective junction box.

Additionally required mounting material (not included in the scope of delivery):

There are several options for attaching the inverter to the framework.

- ☐ The required fastening material must be selected according to the profile rail used.
- ☐ The mounting material has to be made of stainless steel.
- ☐ Diameter of screws: max. $^{5}/_{16}$ in. (M8)

NOTICE

Damage to the PV module due to screws being too long

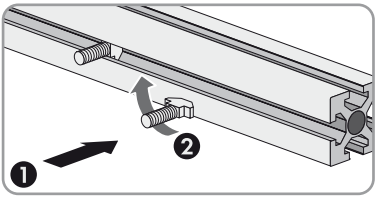
The length of the screws must be suitable for the clearance between the inverter and the PV module bottom side.

- Make sure that the PV module is not damaged by the screws being used.

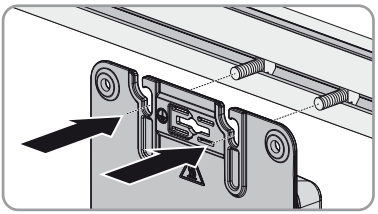
In the following example, mounting with T-head bolts is described.

Procedure:

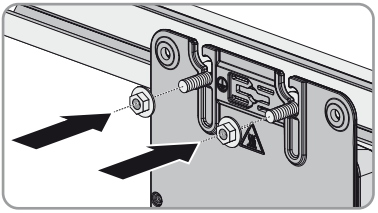
1. Hold the supplied mounting overview in readiness for the allocation of the inverters to the PV modules.
2. In case the connection area points upwards during mounting, make sure to protect the plugs and pin connectors against ingress of moisture.
3. Insert the T-head bolts into the rail and turn by 90°. This will firmly anchor the screws in the rail.



4. Remove the label with the inverter serial number from the inverter and attach it to the corresponding position in the mounting overview included in the delivery. Hint: You can note down the serial number of the inverter on the mounting overview.
5. Position the inverter on the anchored screws. To do this, insert the screws into the oblong holes in the enclosure as far as the required fastening point.



6. Attach the inverter using suitable washers and nuts.



7. Ensure that the inverter is securely in place.
8. Ground the inverter enclosure (see Section 5.3).

5.2.2 Mounting the Inverter on the Wall

To mount the inverter on the wall, proceed as follows.

Additionally required mounting material (not included in the scope of delivery):

- ☐ The mounting material has to be made of stainless steel.
- ☐ Two screws suitable for the building ground
- ☐ Two washers suitable for the screws
- ☐ Two screw anchors suitable for the building ground and the screws

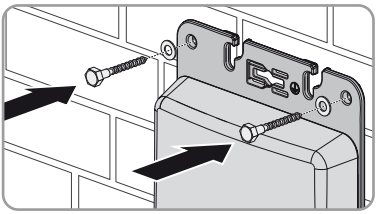
Procedure:

1. **⚠ WARNING**

   Danger of electric shock if electric cables and other supply lines are damaged by drilling

   - Before drilling, ensure that there are no electric cables and supply lines in the wall that could be damaged.

2. Mark the position of the drill holes using the holes in the enclosure. For this, use the two outer holes or the two oblong holes in the middle.
3. Drill the holes.
4. Plug one screw anchor into each hole.
5. Align the inverter with the drill holes and attach it using suitable screws and washers.



6. Ground the inverter enclosure (see Section 5.3).

5.3 Grounding the Inverter Enclosure

In order to connect the equipment grounding conductor, you must ground the inverter enclosure.

You can ground each inverter separately or connect several inverters to one grounding conductor. The equipment grounding conductor must be connected to the equipotential bonding of the AC distribution board.

Information on the illustrations in this section

The figures show an example of the mounted inverter with the lid facing towards the roof. The procedure for grounding a mounted inverter with the rear side facing towards the roof or the wall is identical and is therefore not shown as a figure in this section.

Overview

Figure 13: Material for equipment grounding included in the scope of delivery

Item	Designation
A	Grounding bolt
B	Clamping bracket
C	Washers
D	Hexagon nuts

Ground the inverter enclosure as follows:

Cable requirements:

- ☐ Only use copper cables.
- ☐ Use only cables made of solid wire.
- ☐ Wire size of the equipment grounding conductor: AWG 12 to AWG 6 (4 mm² to 16 mm²)

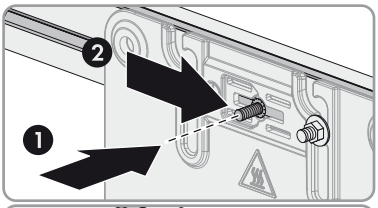
NOTICE

Damage to the PV module due to insufficient clearance between the inverter and the PV module bottom side

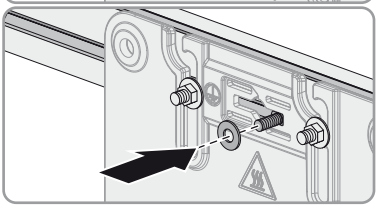
For roof mounting, the clearance from the inverter to the PV module bottom side must be at least $1^{3}/_{16}$ in. (30 mm). As a result, you prevent the grounding bolt from damaging the PV module.

Procedure:

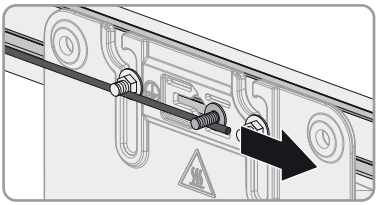
1. Insert the grounding bolt into the hole with the bolt head facing the ground (e.g. rail) and push it to the right-hand stop.



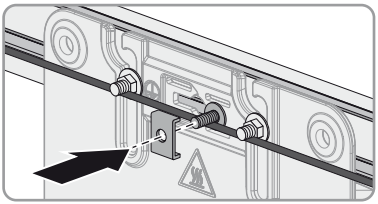
2. Position a washer onto the ground bolt.



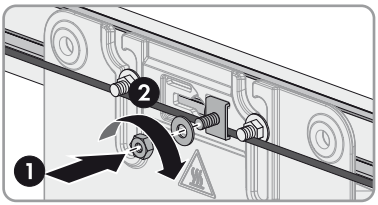
3. Place the equipment grounding conductor horizontally underneath or above the ground bolt.



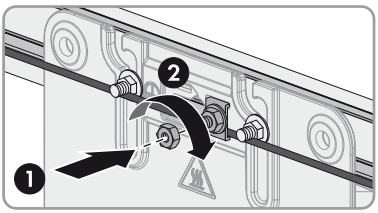
4. Position the clamping bracket on the grounding bolt and above the equipment grounding conductor. Depending on the conductor cross-section, the clamping bracket **does not** necessarily have to lock into place in the horizontal slots.



5. Place the second washer and the hexagon nut on the ground bolt and tighten them (torque: 31 in-lb (3.5 Nm)).



6. Place the second hexagon nut on the ground bolt and tighten it (torque: 31 in-lb (3.5 Nm)).

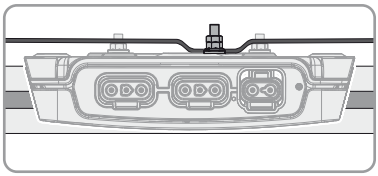


7. **NOTICE**

Prevention of contact corrosion by bending the equipment grounding conductor

The equipment grounding conductor must not be in contact with the inverter enclosure. When there is contact, corrosion at the contact surface may result. The fastening screws and nuts may be in contact.

- Bend the equipment grounding conductor in such a way that it is not in contact with the inverter enclosure.



8. Connect the equipment grounding conductor to the equipotential bonding of the AC distribution board.

5.4 Requirements for the Mounting of the Sunny Multigate

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

- Do not mount the Sunny Multigate on flammable construction materials.
- Do not mount the Sunny Multigate near highly flammable materials.
- Do not mount the Sunny Multigate in potentially explosive atmospheres.

⚠ WARNING

Danger of fire due to non-UL50E industrial enclosure

The Sunny Multigate is only protected against fire if it is installed in an industrial enclosure complying with UL50E. Otherwise, the fire risk could lead to personal injury and property damage.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

NOTICE

Damage to the Sunny Multigate from moisture and dust intrusion

Dust or moisture intrusion can damage the Sunny Multigate and impair its functionality.
The Sunny Multigate must always be installed in an industrial enclosure with back panel complying with UL50E. This ensures that the Sunny Multigate is protected against dust and moisture and is suitable for indoor and outdoor operation.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

☐ The mounting location must be inaccessible to children.

☐ The mounting location must be suitable for the installation of the Sunny Multigate in a industrial enclosure of Type 1 or Type 3.

☐ AC cable route of the entire PV system with Sunny Multigate: maximum 100 ft. (30 m)

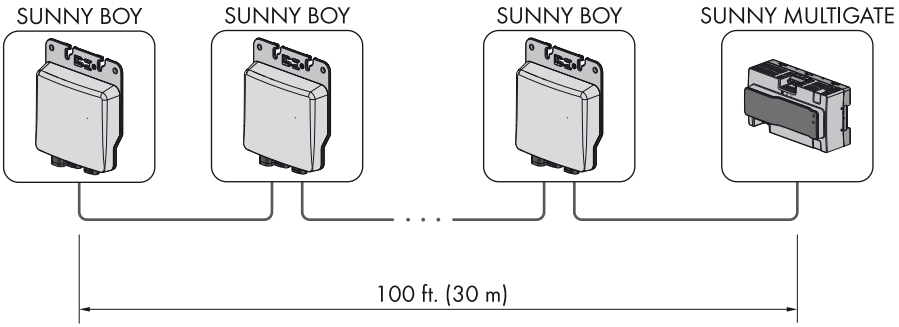


Figure 14: Maximum AC cable route of the PV system

☐ A robust building ground must be available for mounting the device, e.g., concrete, walls. In living areas, make sure that the building ground is not made of plasterboard or similar.

☐ The mounting location must be suitable for the weight and dimensions of the industrial enclosure with the Sunny Multigate (see Section 13.2 "Sunny Multigate-US", page 78).

☐ The mounting location should be clear and safely accessible at all times without the need for any auxiliary equipment (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.

☐ The mounting location should not be exposed to direct solar irradiation.

☐ Climatic conditions must be met (see Section 13.2 "Sunny Multigate-US", page 78).

☐ The ambient temperature must be between –40°F and +113°F (–40°C and +45°C). This will ensure optimal operation of the Sunny Multigate.

Dimensions for mounting with bolts:

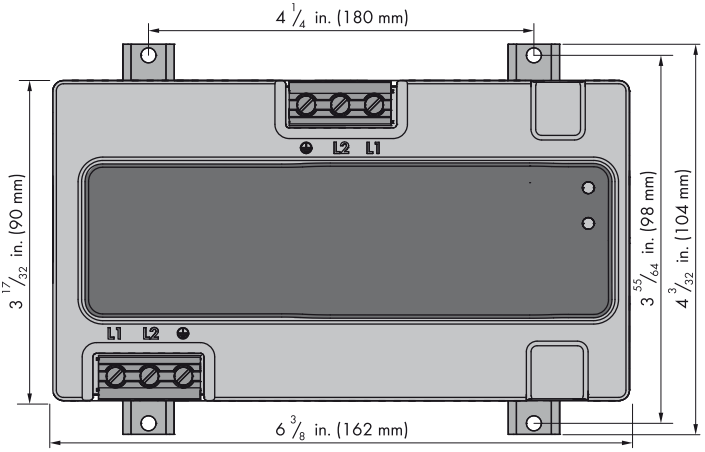


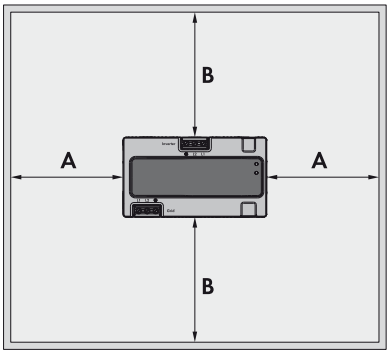
Figure 15: Dimensions of the drill holes for mounting with bolts

Minimum clearances of the metal industrial enclosure:

☐ The minimum clearance of the metal industrial enclosure to the walls has to be $^{1}/_{2}$ in. (12.7 mm) .

Recommended clearances:

☐ Observe the recommended clearances within the industrial enclosure.



A = $^{55}/_{64}$ in. (98 mm) B = 5 $^{29}/_{64}$ in. (150 mm)

Figure 16: Recommended clearances

Permitted mounting positions:

☐ Only mount the Sunny Multigate horizontally in the industrial enclosure.

5.5 Mounting the Sunny Multigate in the Industrial Enclosure

Mounting Options

- Mounting on top-hat rail in industrial enclosure with back panel complying with UL50E
- Mounting with bolts in industrial enclosure with back panel complying with UL50E

Additionally required mounting material (not included in the scope of delivery):

- ☐ For indoor use: industrial enclosure complying with UL50E Type 1
- ☐ For outdoor use: industrial enclosure complying with UL50E Type 3
- ☐ Back panel that is suited for the industrial enclosure complying with UL50E
- ☐ For mounting on top-hat rail: top-hat rail (DIN rail) suitable for the industrial enclosure Width: 1 $^{3}/_{8}$ in. (35 mm), length: 9$^{1}/_{4}$ in. (235 mm)
- ☐ When mounting on press-out lugs: four screws suitable for the size of the lugs and the material of the premounted back panel of the industrial enclosure. Max. permissible height of screw head: $^{15}/_{64}$ in. (6 mm).

Requirements for the industrial enclosure:

- ☐ Industrial enclosure with back panel complying with UL50E, Type 3R for outdoor use and Type 1 for indoor use
- ☐ Pollution degree 3
- ☐ Material: plastic or metal
- ☐ Minimum dimensions (W x H x D):
  10 $^{1}/_{4}$ in. (260 mm) x 9 $^{29}/_{64}$ (240 mm) in. x 4 $^{23}/_{32}$ in. (120 mm)
- ☐ Minimum volume: 19 liters
- ☐ Fire protection class: minimum UL 94 5VA
- ☐ Ambient temperature range: -40°F to 113°F (-40°C to +45°C)
- ☐ A warning label with the following text must be available:

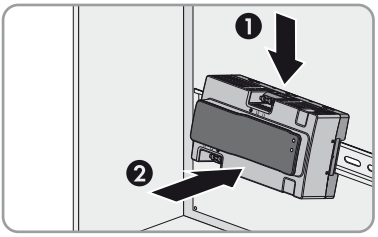
  "DANGER - Risk of Electric Shock. Do not remove cover. No user-serviceable parts inside. Refer servicing to qualified service personnel."

  "DANGER - Hazardous Voltage remains for five minutes after disconnecting main power supply."

  Hint: You can use the warning label included in the scope of delivery. The warning label included in the scope of delivery is made of Scotchcal Brand 3690 from 3M and only suitable for certain surfaces according to U-listing (see E-File Nr. MH18072, category PGJI2). Examples: Alkyd paint, aluminum, Polyester paint, zinc.

Top-Hat Rail Mounting

1. For mounting on a top-hat rail, attach the Sunny Multigate to the top-hat rail from above, and hook it in.
   ☑ The Sunny Multigate snaps into place with an audible click.



2. Ensure that the Sunny Multigate is securely in place.
3. Attach the supplied warning labels clearly legible on the outside of the enclosure lid.

Mounting with Bolts

For mounting with bolts, use the four lugs on the rear panel of the Sunny Multigate.

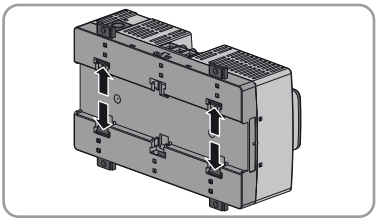
1. **⚠ WARNING**

   Danger to life due to electric shock

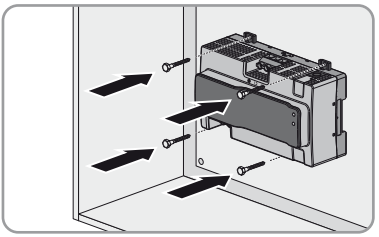
   If screws or conductors on the connecting terminal plate are touched, there is a risk of electric shock.

   - To avoid contact with screws or conductors, only use screws with max. head height of $^{15}/_{64}$ in. (6 mm) for mounting on the brackets.

2. Press the brackets out from the inside.
   ☑ The brackets snap audibly into place.



3. Mark the drill holes on the back panel using the brackets as a template.
4. Drill the holes into the back panel.
5. Insert screws with a maximum head height of $^{15}/_{64}$ in. (6 mm) through the brackets and tighten. Make sure not to damage the brackets.



6. Ensure that the Sunny Multigate is securely in place.
7. Attach the supplied warning labels clearly legible on the outside of the industrial enclosure lid.

5.6 Grounding the Metal Industrial Enclosure

If you use an industrial enclosure made of metal, you must ground the industrial enclosure in accordance with the *National Electrical Code*® and the following procedure.

Additionally required material (not included in the scope of delivery):

- ☐ Connecting terminal plate for grounding the industrial enclosure, its door and the Sunny Multigate
- ☐ Cable type: copper with conductor cross-section of at least AWG 14 (2.5 mm²)
- ☐ Cable type: aluminum made of copper-coated wire with conductor cross-section of at least AWG 12 (4 mm²)

- Connect the grounding of the industrial enclosure to the grounding of the Sunny Multigate and the door of the industrial enclosure. Use the connecting terminal plate for grounding.

6 Electrical Connection

6.1 Safety during Electrical Connection

⚠ DANGER

Danger to life due to electric shock. Do not disconnect under load

PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

- Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
- Ensure that the PV modules are covered.

⚠ DANGER

Risk of electric shock due to contact with live components when opening the Sunny Multigate

There are live components inside the Sunny Multigate. There is a risk of electric shock if you open the Sunny Multigate.

- **Never** open the Sunny Multigate.

NOTICE

Damage to the inverter due to moisture penetration

When the inverter is open, moisture can penetrate and cause damage to the inverter.
The inverter is no longer water-tight and its function may be impaired.

- **Never** open the inverter.

⚠ CAUTION

Risk of fire

- To reduce the risk of fire, connect only to a circuit provided with 15 A maximum branch-circuit overcurrent protection in accordance with the *National Electrical Code®* (NE, ANSI/NFPA 70).

Electrical installations

All electrical installations must be carried out in accordance with the local electrical standards and the *National Electrical Code*® ANSI/NFPA70 or the *Canadian Electrical Code*®.CSA C22.1.

- With an ungrounded PV array/PV module the *National Electrical Code*®, ANSI/NFPA 70 wiring methods are to be used, including Sec. 690.35.
- The provisions in *National Electrical Code*® article 690.8 (A)(3) for determination of the maximum micro inverter output circuit current apply to this product.
- The circuit conductors and overcurrent devices are considered to be subjected to the maximum micro inverter output circuit current and shall be sized to carry not less than 125% of the maximum currents as required by *National Electrical Code*® article 690.8(A)(3).
- The overcurrent protection for the AC output circuit is to be provided by others.
- If cables of type TC-ER (Tray Cable Exposed Run) are used, observe the requirements of the *National Electrical Code*®, article 336.10.
- Ensure that no cables used for electrical connection are damaged.

6.2 Connection Areas

6.2.1 Sunny Boy

View from Below

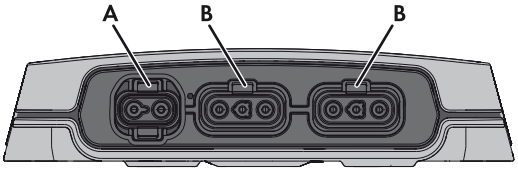


Figure 17: Connection areas at the bottom of the inverter

Item	Designation	Explanation
A	DC pin connector	Terminal for the supplied DC plug
B	AC pin connector	• For AC cable connection for connecting two inverters (Daisy chain) • For AC cable connection for connecting the first inverter to the Sunny Multigate • For inserting the protective cap

6.2.2 Sunny Multigate-US

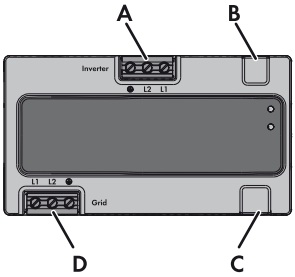


Figure 18: Connection areas on the Sunny Multigate

Item	Designation
A	Connecting terminal plate for the connection of the AC cable of the inverter, labeling: **Inverter**
B	Pin connector for connecting optional communication
C	Pin connector for connecting network cable (RJ45)
D	Connecting terminal plate for the connection of the AC cable of the utility grid, labeling: **Grid**

6.3 Connecting the AC Cable to the Inverters

Overview

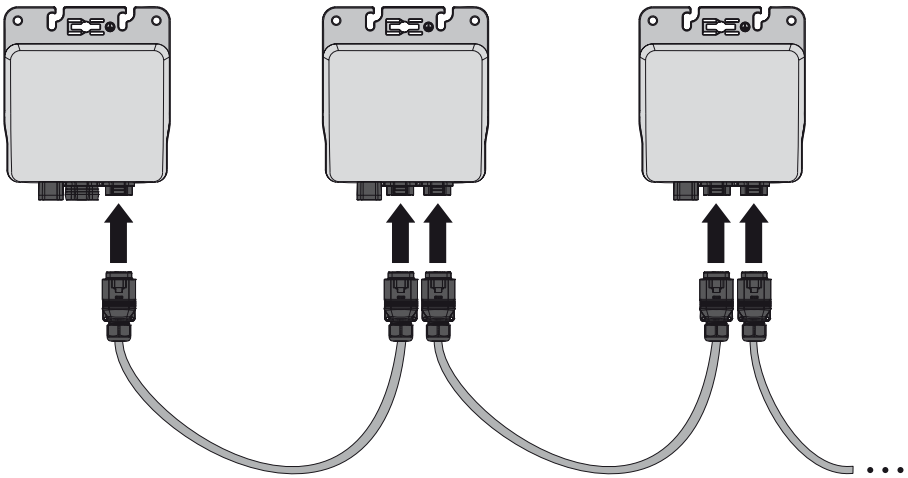


Figure 19: AC cabling between inverters

Requirements:

- ☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code*® (NE, ANSI/NFPA 70) (see *National Electrical Code*®, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code*® CSA C22.1.
- ☐ The maximum output current of the inverter must comply with the *National Electrical Code*®, paragraph 690.8 (A)(3).
- ☐ For fusing purposes, use a circuit breaker no larger than 2-pole, 15 A.
- ☐ Overcurrent protection must comply with the *National Electrical Code*®, paragraph 690.9.
- ☐ For the AC cable connection to the Sunny Boy, only use the supplied AC cable (see Section 14 "Accessories", page 80).
- ☐ Only use cables of type TC-ER observing the requirements of the *National Electrical Code*®, article 336.10.

Procedure:

1. **⚠ DANGER**

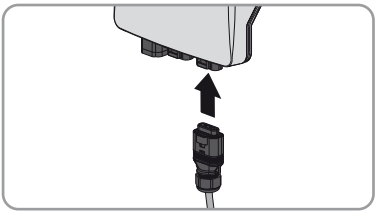
   Danger to life due to electric shock. Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

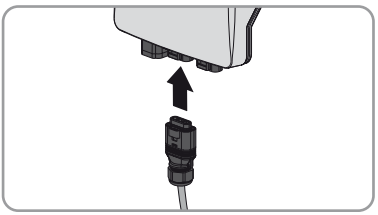
2. Plug one end of the supplied AC cable into the outer AC pin connector of the last inverter.

   ☑ The plug snaps audibly into place.



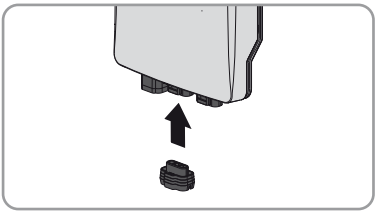
3. Plug the other end of the AC cable into the middle AC pin connector of the next inverter.

   ☑ The plug snaps audibly into place.



4. Plug the protective cap into the free AC pin connector of the last inverter.

   ☑ The protective cap snaps audibly into place.



5. Ensure that the AC connectors and the protective cap in the inverter pin connectors are securely in place.
6. Connect the free end of the AC cable of the first inverter to the AC field plug or to the terminal of the junction box as follows:
   - Option 1: via AC field plug (see Section 6.6 "Option 1: AC Cabling with AC Field Plug", page 45).
   - Option 2: via junction box with feed-through terminal (see Section 6.7 "Option 2: AC Cabling with Junction Box", page 49).
7. Connect the PV module to the inverter (see Section 6.4)

6.4 Connecting the PV Module to the Inverter

NOTICE

Damage to the inverter due to moisture penetration

When the inverter is open, moisture can penetrate and cause damage to the inverter. The inverter is no longer water-tight and its function may be impaired.

- **Never** open the inverter.

Only connect one PV module to each inverter in accordance with the following procedure.

Requirements:

☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code*® (NE, ANSI/NFPA 70) (see *National Electrical Code*®, paragraph 690 8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code*® CSA C22.1.

☐ The PV modules must be correctly mounted in accordance with the manufacturer specifications.

☐ Each inverter must be connected to no more than one PV module.

☐ The limiting values for the input voltage and the input current of the inverter must be observed.

☐ The positive connection cable (DC+) of the PV module must be fitted with a positive DC connector suitable for the DC connector of the inverter.

☐ The negative connection cable (DC-) of the PV module must be fitted with a negative DC connector suitable for the DC connector of the inverter.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock. Do not disconnect under load

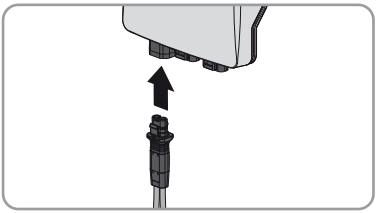
   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

2. Check the PV module for ground faults (see Section 11.3)
3. Check the DC connectors of the PV module for correct polarity and connect to the DC connectors of the supplied DC plug. Tip: for correct assignment, the DC plug is marked with + and –.

   ☑ The DC connectors click into place.
4. Ensure that the DC connectors are securely in place.

5. Insert the DC plug with the DC connectors into the outer pin connector on the inverter.



6. Connect the first inverter of the PV system to the Sunny Multigate (see Section 6.8).

6.5 AC Cabling from Inverter to Sunny Multigate

You have the option of implementing the AC cabling from the inverter to the Sunny Multigate using either the supplied AC field plug or a junction box with integrated feed-through terminal.

Option 1

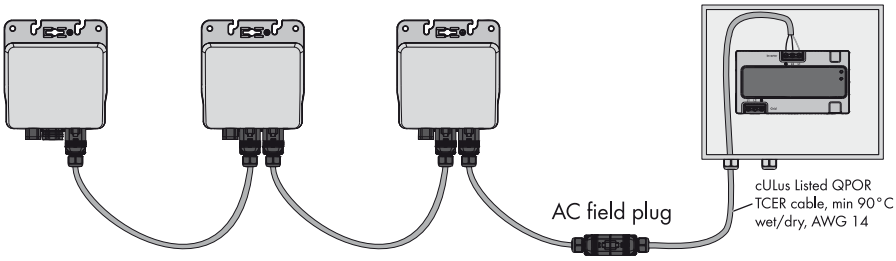


Figure 20: AC cabling of the entire PV system with AC field plug

Option 2

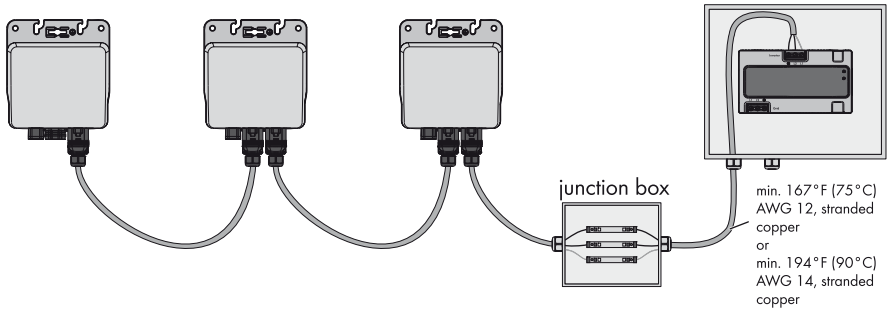


Figure 21: AC cabling of the entire PV system with junction box (example)

6.6 Option 1: AC Cabling with AC Field Plug

6.6.1 Assembling the AC Field Plug

The AC cable with the two connectors is used to connect the inverters. You will need the supplied AC field plug to connect the inverter to the Sunny Multigate.

Overview

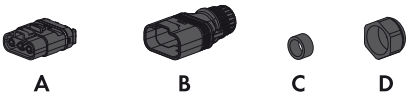


Figure 22: Elements of the AC field plug

Item	Designation
A	Insulator
B	Enclosure
C	Seal
D	Nut

Additionally required material (not included in the scope of delivery) (see Section 14 "Accessories", page 80):

- ☐ Three bootlace ferrules AWG 14 (2.5 mm²)
- ☐ Cable complying with UL6703
- ☐ Cable shears with insulated grips, $6^1/_2$ in. (165 mm)
- ☐ Stripping knife with straight blade, TiN $^5/_{16}$ in. to 1 $^7/_{64}$ in. (8 mm to 28 mm)
- ☐ Insulation stripping tool, AWG 7 (10 mm²)
- ☐ Crimping tool for bootlace ferrules, AWG 7 (10 mm²)
- ☐ Torque screwdriver, 1.4" hexagon socket, 2.7 in-lb to 10.6 in-lb (0.3 Nm to 1.2 Nm)
- ☐ Bit, 1.4" hexagon, 1 in. (25 mm), for cross-head screws
- ☐ Torque wrench, scale adjustable, 17.7 in-lb to 177 in-lb (2 Nm to 20 Nm)
- ☐ Crow's foot wrench, AF 25
- ☐ Square insertion tool, outer square: $^3/_8$ in., inner square: 9x12
- ☐ Screwdriver, insulated with blade width $^5/_{32}$ in. (4 mm) and blade thickness $^1/_{32}$ in. (0.8 mm)

Cable requirements:

- ☐ Cable cross-section: AWG 14 (2.5 mm²)
- ☐ Cable type: UL listed (QPOR) Power and Control Tray cable, type TC-ER (LAPP-Tray Cable II A 3 G AWG 14/46 BK)
- ☐ Temperature: at least +194°F (+90°C) wet/dry
- ☐ External diameter of the cable sheath: $^{11}/_{32}$ in. to $^{3}/_{8}$ in. (8.8 mm to 9.6 mm)
- ☐ Number of stranded wires: 46
- ☐ Wire cross-section: AWG 30
- ☐ Cable type: copper wire

Assemble the AC field plug as follows:

⚠ DANGER

Danger to life due to electric shock

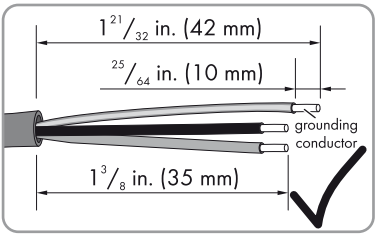
- Do not disconnect or connect the AC field under load.
- Only assemble the AC field plug in a dry environment.
- Observe the operating temperature range of -40°F to +185°F (-40°C to +85°C).
- Note and adhere to the requirements of the *National Electrical Code®*, ANSI/NFPA 70).

Procedure:

Assembling the Cable

1. Shorten the cable to the desired length using cable shears.
2. Strip the shortened cable by $1^{21}/_{32}$ in. (42 mm) using the stripping knife. Take care not to damage the individual insulated conductors.
   - The grounding conductor must be $1^{21}/_{32}$ in. (42 mm) long. The grounding conductor must be approximately $^{9}/_{32}$ in. (7 mm) longer than L1 and L2.
   - L1 and L2 must each be $1^{3}/_{8}$ in. (35 mm) long.
3. Using the insulation stripping tool, strip the insulation of the three insulated conductors each by $^{3}/_{8}$ in. (10 mm) (tolerance: ± $^{3}/_{64}$ in. / ± 1 mm). Take care not to cut into any of the individual stranded wires.

   ☑ The cable is assembled.



4. Push one bootlace ferrule onto each stripped insulated conductor up to the stop. Do not touch the stranded wires with your fingers and do not change the twist direction of the stranded wires.
5. Crimp the bootlace ferrule tightly using a crimping tool.
6. Ensure that a crimping length of max. $^{3}/_{32}$ in. (2.4 mm) is maintained.

Pre-Mounting the AC Field Plug

1. Slide the nut over the cable with the bootlace ferrules. Ensure that the thread of the nut is facing the bootlace ferrule.
2. Use your fingers to push the seal as far as possible into the AC plug enclosure.
3. Lead the AC plug enclosure with the seal over the cable. The thread must be facing the thread of the nut.

Mounting the Insulator

1. Push the stranded wires with the bootlace ferrules up to the stop in the pre-mounted pin connectors inside the insulator. L1 must be plugged into pin connector **L1**, L2 into pin connector **L2** and the grounding conductor into the pin connector with the symbol ⏚.

   ☑ The bootlace ferrules are no longer visible.
2. Tighten the three screws in the insulator using a screwdriver (torque: 7 in-lb (0.8 Nm)).
3. Ensure that the individual stranded wires are positioned securely in the correct pin connectors of the insulator.

Completing Mounting of the AC Field Plug

1. Push the AC plug enclosure onto the insulator.

   ☑ The two parts snap audibly together. The catch mechanism on the insulator and on the AC plug enclosure must be correctly aligned.
2. Screw the nut onto the AC plug enclosure and tighten with two different torques using a torque wrench:
   - First tighten the nut with a torque of 29.2 in-lb (3.3 Nm). To do so, set the value 26.6 in-lb (3.0 Nm) at the scale of the torque wrench specified by SMA.
   - Then tighten the nut with a torque of 45.1 in-lb. (5.1 Nm). To do so, set the value 40.7 in-lb (4.6 Nm) at the scale of the torque specified by SMA.

   Tip: The indicated torque only applies to the torque wrench specified by SMA. The value to be set on the torque wrench is lower than the actual value (for more information on the calculation of the torque to be set, visit www.stahlwille.com). A torque wrench consists of the following components: torque wrench (basic device), square insertion tool and crow's foot wrench.
3. Make sure that the nut of the AC plug enclosure is securely fastened.

6.6.2 Connecting the AC Field Plug to the AC Cable of the Inverter

1. **⚠ DANGER**

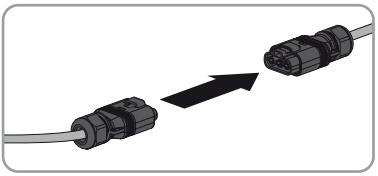
   Danger to life due to electric shock

   Do not connect the AC field plug under load.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

2. Plug the free end of the AC cable connected to the inverter into the pin connector of the assembled AC field plug.

   ☑ The AC field plug snaps audibly into place. The catch mechanisms of both plugs must be correctly aligned.



6.6.3 Disconnecting the AC Field Plug from the AC Cable of the Inverter

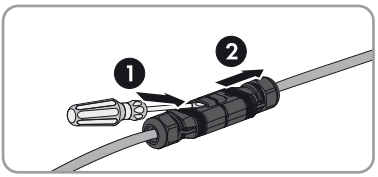
1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect the AC field plug under load.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

2. Unlock and remove the AC field plug from the AC connector of the inverter. To do this, hook a slotted screwdriver (blade width: 4 mm) into the wide slot at the AC field plug and lever it open. At the same time, pull out the AC connector.



6.6.4 Removing and Reassembling the AC Field Plug

Removing and reassembling the AC field plug is only possible within 72 hours

- In total, the AC field plug must at maximum be removed three times and only within the first 72 hours after the first assembly.
- After the period of 72 hours has expired, the AC field plug must not be removed.
- The cable must be shortened again before each assembly.

Procedure:

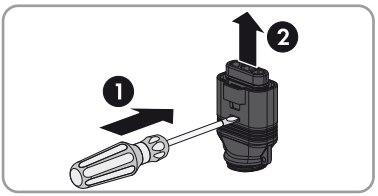
1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect the AC field plug under load.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

2. Disconnect the AC field plug from the AC cable of the inverter (see Section 6.6.3).
3. Loosen the nut of the AC plug enclosure.
4. Remove the seal from the opening of the thread. Make sure not to damage the fins of the AC plug enclosure.
5. Detach the AC plug enclosure from the insulator. To do this, insert a slotted screwdriver (blade width: 4 mm) into the small slot of the AC plug enclosure and unlock the fastening clamps until the insulator is detached from the AC plug enclosure.



6. Loosen all three screws using a screwdriver and remove the conductors.
7. Shorten the cable and reassemble the AC field plug (see Section 6.6.1).

6.7 Option 2: AC Cabling with Junction Box

As an alternative to the AC field plug, you can use a junction box with feed-through terminal for the connection of the inverter AC cable to the Sunny Multigate.

For the assembly and connection of the AC cable, follow the instructions of the junction box manufacturer. All electrical installations must be carried out in accordance with the locally applicable electrical standards and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)).

- This cable assembly must be installed in an in-accessible location or in a *National Electrical Code®* compliant conduit.

6.8 Connecting the Inverter to the Sunny Multigate

Connect the free end of the AC cable coming from the AC field plug or the junction box to the connecting terminal plate of the Sunny Multigate. The connecting terminal plate assigned for this is labelled **Inverter**.

Additionally required tools (not included in the scope of delivery):

☐ Slotted screwdriver (blade width: 3.5 mm)

Requirements:

☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code*® (NE, ANSI/NFPA 70) (see *National Electrical Code*®, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code*® CSA C22.1.

☐ The Sunny Multigate is correctly installed in the industrial enclosure.

Cable requirements:

☐ Do not use shielded cables.

☐ Only use copper cables.

☐ Only use cables with stranded wires.

☐ Temperature: at least +194°F (+90°C) wet/dry

☐ Conductor cross-section: AWG 16 to AWG 10 (1.5 mm² to 6 mm²)

☐ Do not use *Wire Nuts*®.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock. Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Ensure that the PV modules are covered.

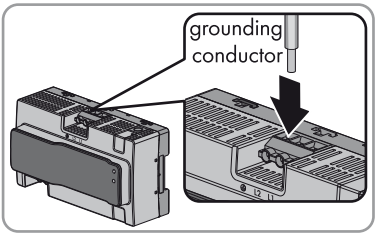
2. Route the AC cable of the inverter through one opening at the bottom of the industrial enclosure to the **Inverter** terminal of the Sunny Multigate.
3. Strip the insulation of the three AC cable conductors by $^{5}/_{16}$ in. (8 mm).
4. ***NOTICE***

   Damage to the Sunny Multigate due to incorrectly connected conductors

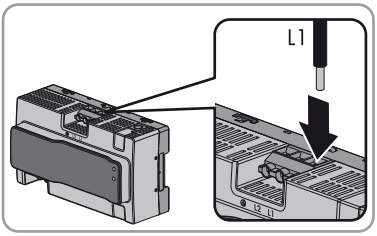
   If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

   - Be sure to observe the terminal labels on the Sunny Multigate.
   - Connect all conductors according to the terminal labels.

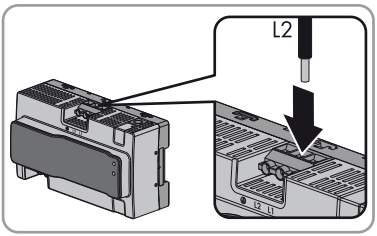
5. Connect the grounding conductor of the AC cable to the terminal ⏚ of the Sunny Multigate.
   Make sure that the conductor is inserted into the terminal right up to the stop.



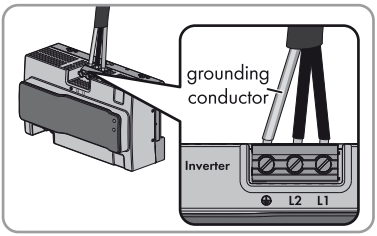
6. Connect the conductor L1 of the AC cable to the terminal **L1** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



7. Connect the conductor L2 of the AC cable to the terminal **L2** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



8. Tighten all three screws of the connecting terminal plate using a slotted screwdriver (torque: 5.31 in-lb (0.6 Nm)).
9. Ensure that all terminals are correctly allocated.



10. Ensure that all conductors are securely in place.

6.9 Connecting the Sunny Multigate to the Utility Grid

Connect the AC cable of the utility grid to the connecting terminal plate of the Sunny Multigate labelled **Grid** according to the following procedure:

Additionally required tools (not included in the scope of delivery):

☐ Slotted screwdriver (blade width: 3.5 mm)

Cable requirements:

☐ Only use copper cables.

☐ Only use cables with stranded wires.

☐ Temperature: at least +194°F (+90°C) wet/dry

☐ Conductor cross-section: AWG 16 to AWG 10 (1.5 mm² to 6 mm²)

☐ Do not use *Wire Nuts*®.

Requirements:

☐ All electrical installations must be carried out in accordance with all electrical standards applicable on site and the *National Electrical Code*® (NE, ANSI/NFPA 70) (see *National Electrical Code*®, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code*® CSA C22.1.

☐ The maximum output current of the inverter must comply with the *National Electrical Code*®, paragraph 690.8 (A)(3).

☐ Overcurrent protection must comply with the *National Electrical Code*®, paragraph 690.9.

☐ The Sunny Multigate must be correctly installed in the industrial enclosure.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   - Ensure that the two-pole circuit breaker is switched off and cannot be reconnected.

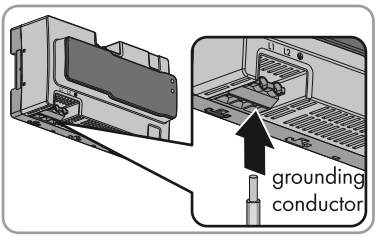
2. Route the AC cable of the utility grid through one opening at the bottom of the industrial enclosure to the **Grid** terminal of the Sunny Multigate.
3. Strip the insulation of the three AC cable conductors of the utility grid each by $^{5}/_{16}$ in. (8 mm).
4. ***NOTICE***

   Damage to the Sunny Multigate due to incorrectly connected conductors

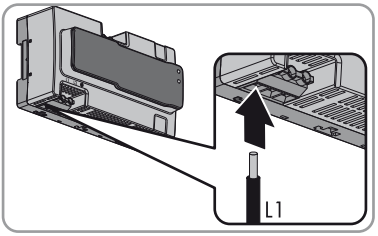
   If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

   - Be sure to observe the terminal labels on the Sunny Multigate.
   - Connect all conductors according to the terminal labels.

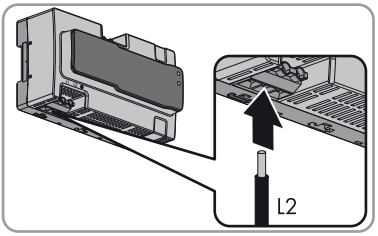
5. Connect the grounding conductor of the AC cable to the terminal ⏚ of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



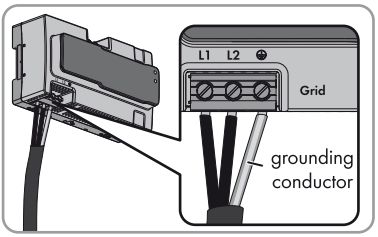
6. Connect the conductor L1 of the AC cable to the terminal **L1** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



7. Connect the conductor L2 of the AC cable to the terminal **L2** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



8. Tighten all three screws of the connecting terminal plate using a slotted screwdriver (torque: 5.31 in-lb (0.6 Nm)).
9. Ensure that all terminals are correctly allocated.



10. Ensure that all conductors are securely in place.
11. Connect the grounding conductor of the Sunny Multigate to the equipotential bonding of the AC distribution board.

7 Commissioning

Requirements:

☐ All inverters are correctly installed.

☐ The AC connector is firmly plugged in.

☐ The DC plug and the connectors are firmly plugged in.

☐ The connection areas of all inverters are dry and sealed rain-tight by means of connectors and, where applicable, the protective cap.

☐ The PV modules are correctly installed.

☐ The two-pole circuit breaker must be correctly rated.

☐ The Sunny Multigate is correctly installed in the industrial enclosure.

☐ The unused AC pin connector on the last inverter of the PV system is sealed with the protective cap.

☐ The first inverter of the PV system is correctly connected to the Sunny Multigate via the AC cable. All conductors must be connected according to the terminal labels. No conductors must be swapped.

☐ The AC cable of the utility grid is correctly connected to the Sunny Multigate. All conductors must be connected according to the terminal labels. No conductors must be swapped.

NOTICE

Damage to the Sunny Multigate due to incorrectly connected conductors

If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

- Be sure to observe the terminal labels on the Sunny Multigate.
- All conductors must be connected according to the terminal labels.
- Ensure that all terminals are correctly allocated.

Procedure:

- Switch the two-pole circuit breaker on.

☑ Both LEDs on the Sunny Multigate are glowing green. Feed-in operation begins.

✖ The LED **Inverter** is off?

There is a disturbance in the PV system.

- You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2 "Events: Information, Warnings and Errors", page 65).

✖ The LED **Inverter** on the Sunny Multigate is glowing orange or red?

There is a disturbance in at least one of the connected inverters.

- You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2 "Events: Information, Warnings and Errors", page 65).

✖ The LED **Multigate** on the Sunny Multigate is glowing orange or red?

There is a disturbance in the Sunny Multigate.

- Identify and eliminate the error (see Section 11.1 "LED Signals on the Sunny Multigate", page 63).

8 Configuration

8.1 Connecting the Sunny Multigate to the Network

You can configure the Sunny Multigate and the inverters using an SMA communication product (e.g. Sunny Portal, Sunny Explorer).

Required material (not included in the scope of delivery):

☐ 1 network cable

Cable requirements:

☐ Cable type: 100BaseTx, CAT5 with S-FTP or S-STP shielding. SMA recommends the cable type "SMA COMCAB-OUT-xxx" for outdoors, and the cable type "SMA COMCAB-IN-xxx" for indoors in the lengths xxx = 328 ft. (100 m), 656 ft. (200 m), 1,640 ft. (500 m), 3,280 ft. (1,000 m).

☐ Cross-section: at least 2 x 2 x 0.22 mm² or at least 2 x 2 x AWG 24

☐ Maximum cable length: 328 ft. (100 m)

☐ UV-resistant for outdoor use

☐ Type of plug: RJ45

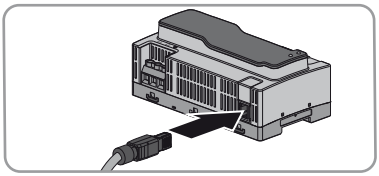
Requirements:

☐ The PV system is commissioned (see Section 7 "Commissioning", page 54).

☐ A computer with an Ethernet interface must be available.

Procedure:

1. Connect one end of the network cable to the router or directly to the computer.
2. Plug the other end of the network cable into the pin connector at the bottom of the Sunny Multigate.



☑ The green LED in the pin connector is glowing or flashing. The Sunny Multigate is connected to the router or to the computer.

☑ The green LED in the pin connector is glowing or flashing and the yellow LED is glowing: A 100 Mbit connection to the router or to the computer is established.

✖ All LEDs in the pin connector are off?

Possible failure cause: the other end of the network cable is not correctly attached or there is no voltage supply.

- Ensure that the computer or router is supplied with voltage.
- Ensure that the network cable is correctly attached.
- If the network cable is correctly attached and the problem persists, contact the SMA Service Line (see Section 16 "Contact", page 83).

8.2 Registering the Sunny Multigate in Sunny Portal

If you want to use the Webconnect function and monitor your PV system in Sunny Portal, you must register the Sunny Multigate in Sunny Portal.

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 54).
- ☐ The Sunny Multigate must be connected to a router or modem with Internet access and must be integrated in your network. If the router or modem does not support DHCP, or if DHCP is deactivated, you can use the SMA Connection Assist to integrate the Sunny Multigate into your network (see www.SMA-Solar.com).
- ☐ All UDP ports > 1024 on the router or modem must be open for outgoing connections. If there is a firewall installed on the router or modem, you might have to adjust the firewall rules.
- ☐ It must be possible for the outgoing router or modem connections to reach all Internet destinations (target IP, target port). If there is a firewall installed on the router or modem, you might have to adjust the firewall rules.
- ☐ On a router or modem with NAT (Network Address Translation) there should not be any port forwarding. Potential communication problems can thus be prevented.
- ☐ There must be no packet filtering or manipulation for SIP packets on the router or modem.
- ☐ The registration ID (RID) and identification key (PIC) for registration in Sunny Portal must be available (see additional label on the Sunny Multigate enclosure).

Procedure:

- Register the Sunny Multigate in Sunny Portal (see User Manual "Micro Inverter in Sunny Portal" at www.SunnyPortal.com).

8.3 Connecting the Sunny Multigate to Sunny Explorer

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 54).
- ☐ A computer with an Ethernet interface must be available.
- ☐ The Sunny Multigate must be connected to the network.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.

Procedure:

- Start Sunny Explorer and create a PV system (see Sunny Explorer user manual at www.SMA-Solar.com).

8.4 Changing the System Time and System Password

To protect the inverter against unauthorized access and administer the PV system correctly, change the standard system password and the system time by means of Sunny Explorer (for further information refer to the manual or help of the Sunny Explorer).

Requirements:

- ☐ A computer with an Ethernet interface must be available.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.
- ☐ The system must be registered in Sunny Explorer.

Procedure:

1. Access the Sunny Explorer user interface.
2. Change the standard system password. This protects your PV system from unauthorized access.
3. Change the system time.

8.5 Changing the Operating Parameters

By default, the inverter is set to a specific country data set. You can find the country data set to which the inverter has been set on the enclosed Production Test Report or on the type label. Each country data set contains various operating parameters, which can be individually set according to the respective country. After commissioning, you can change the parameters in Sunny Explorer:

Requirements:

- ☐ A computer with an Ethernet interface must be available.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.
- ☐ The system must be registered in Sunny Explorer.
- ☐ The changes to the grid-relevant parameters must be approved by the responsible grid operator.

Procedure:

1. Access the Sunny Explorer user interface.
2. Select and set the desired parameter.
3. Save setting.

8.6 Deactivating the Webconnect Function

Requirements:

☐ A computer with an Ethernet interface must be available.

☐ Sunny Explorer from software version 1.06 must be installed on the computer.

☐ The PV system must be logged in Sunny Explorer.

Procedure:

1. Access the Sunny Explorer user interface.
2. Select the parameter **Webconnect functionality switched on** and set to **No**.
3. Save setting.

8.7 Adjustable Parameters

You can change the following parameters for voltage and frequency monitoring in Sunny Explorer (see also user manual of Sunny Explorer at www.SMA-Solar.com).

Name	Value/range	Default value
Voltage monitoring median maximum threshold (Overvoltage/Fast)	240 V to 270 V	270.0 V
Voltage monitoring lower maximum threshold (Overvoltage/Slow)	240 V to 270 V	264.0 V
Voltage monitoring upper minimum threshold (Undervoltage/Slow)	120 V to 240 V	211.2 V
Voltage monitoring of median minimum threshold (Undervoltage/Fast)	120 V to 240 V	120.0 V
Voltage monitoring median max. threshold trip.time (Overvoltage/Fast, maximum time)	0.1 s to 2.5 s	0.16 s
Voltage monitoring lower max. threshold trip. time (Overvoltage/Slow, maximum time)	0.1 s to 5.0 s	1.0 s
Voltage monitoring upper min. threshold trip. time (Undervoltage/Slow, maximum time)	0.1 s to 5.0 s	2.0 s
Voltage monitoring median min. threshold trip.time (Undervoltage/Fast, maximum time)	0.1 s to 2.5 s	0.16 s
Frequency monitoring lower maximum threshold (Overfrequency)	50.0 Hz to 63.0 Hz	60.5 Hz
Frq. monitoring lower max. threshold trip. time (Underfrequency)	45.0 Hz to 60.0 Hz	59.3 Hz
Frequency monitoring median minimum threshold (Underfrequency fast)	45.0 Hz to 60.0 Hz	57.0 Hz
Frq. monitoring lower max. threshold trip. time (Overfrequency, maximum time)	0.1 s to 90.0 s	0.16 s
Frequency monitoring upper min. threshold trip. time (Underfrequency, maximum time)	0.1 s to 300.0 s	0.16 s
Frequency monitoring median min. threshold trip. time (Underfrequency fast, maximum time)	0.1 s to 2.5 s	0.16 s

9 Disconnecting the Inverter from Voltage Sources

Additionally required tools (not included in the scope of delivery):

☐ Slotted screwdriver (blade width: 4 mm)

NOTICE

Damage to the inverter due to moisture ingress

When the inverter is open, moisture can penetrate and cause damage to the inverter. The inverter is no longer water-tight and its function may be impaired.

- **Never** open the inverter.

NOTICE

Destruction of the multimeter due to overvoltage

- Only use multimeters with a DC input voltage range up to at least 600 V.

Before working on the inverter, always disconnect the inverter from all voltage sources as described in this section. Observe the given sequence.

If you want to disconnect several inverters from voltage sources, you must repeat the following procedure for each inverter.

Procedure:

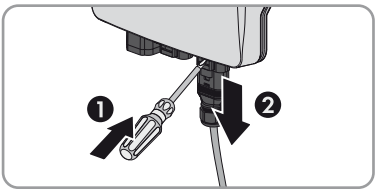
1. **⚠ DANGER**

   Danger to life due to electric shock. Do not disconnect under load

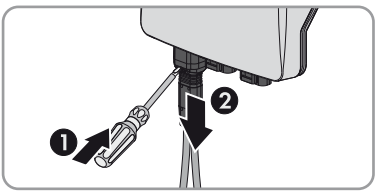
   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Disconnect the two-pole circuit breaker and secure against re-connection.
   - Cover the PV modules.

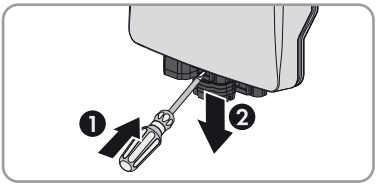
2. Release and disconnect all connected AC connectors from the inverter. To do this, hook a slotted screwdriver (blade width: 4 mm) into the wide slot on the plug and lever it open. At the same time, pull out the AC connector (without pulling the cable).



3. Release and remove the DC plug from the inverter. Hook a slotted screwdriver (blade width: 4 mm) into the wide slot on the plug and lever it open. At the same time, pull out the DC plug (without pulling the cables).



4. Ensure that no voltage is present at the DC pin connector on the inverter. Use a suitable multimeter for this.
5. Use a slotted screwdriver to remove the protective cap. Hook the slotted screwdriver (blade width: 4 mm) into the wide slot and lever it open. At the same time, pull out the protective cap.



6. **⚠ DANGER**

   Danger of electric shock due to high voltages

   - Before carrying out any of the following work, wait five minutes for the capacitors to discharge.

10 Disconnecting the Sunny Multigate from Voltage Sources

⚠ DANGER

Risk of electric shock due to contact with live components when opening the Sunny Multigate

There are live components inside the Sunny Multigate. There is a risk of electric shock if you open the Sunny Multigate.

- **Never** open the Sunny Multigate.

Before working on the Sunny Multigate, always disconnect it from voltage sources as described in this section.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   - Disconnect the two-pole circuit breaker and secure against re-connection.
2. Ensure that no voltage is present at the AC terminal **Grid** between conductor L1 and the grounding conductor. Use a suitable multimeter for this.
3. Ensure that no voltage is present at the AC terminal **Grid** between conductor L2 and the grounding conductor. Use a suitable multimeter for this.
4. Ensure that no voltage is present at the AC terminal **Inverter** between conductor L1 and the grounding conductor. Use a suitable multimeter for this.
5. Ensure that no voltage is present at the AC terminal **Inverter** between conductor L2 and the grounding conductor. Use a suitable multimeter for this.

11 Troubleshooting

11.1 LED Signals on the Sunny Multigate

The LEDs on the Sunny Multigate indicate the operating state of the PV system.

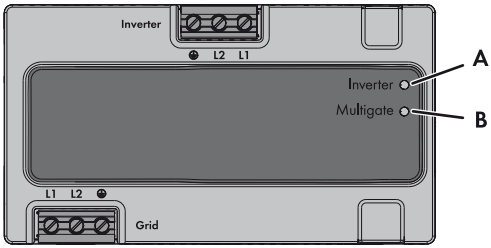


Figure 23: Position of the LEDs on the Sunny Multigate

The upper LED is labelled with **Inverter** and indicates the operating state of the inverters.

The lower LED is labelled with **Multigate** and indicates the operating state of the Sunny Multigate.

LED	Status	Explanation
A: LED **Inverter**	off	The communication with the inverters is not active.
	glowing green	The inverters are in operation.
	glowing orange	At least one of the connected inverters is in **Warning** mode. You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2).
	glowing red	At least one of the connected inverters is in **Fault** mode. You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2).

LED	Status	Explanation
B: LED **Multigate**	off	Either there is no AC voltage present or the Sunny Multigate is defective.
	glowing green	The Sunny Multigate is in normal operating state.
	glowing orange	The Sunny Multigate is in **Warning** mode. 1. If communication is possible, determine the respective error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2). 2. If no communication is possible, disconnect the network cable from the Sunny Multigate and reconnect the Sunny Multigate again to the network (see Section 8.1). 3. If the error persists, disconnect the Multigate from voltage (see Section 10) and reconnect it (see Section 6.9 "Connecting the Sunny Multigate to the Utility Grid", page 52). 4. If the error persists, contact the SMA Service Line.
	glowing red	The Sunny Multigate is in **Fault** mode. 1. If communication is possible, determine the respective error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2). 2. If no communication is possible, disconnect the network cable from the Sunny Multigate and reconnect the Sunny Multigate again to the network (see Section 8.1). 3. If the error persists, disconnect the Multigate from voltage (see Section 10) and reconnect it (see Section 6.9 "Connecting the Sunny Multigate to the Utility Grid", page 52). 4. If the error persists, contact the SMA Service Line.

11.2 Events: Information, Warnings and Errors

During operation of the PV system, events may occur which can refer to one or several inverters or the Sunny Multigate. Events can be information, warnings or errors. All events are displayed in the communication product you are using (e.g. Sunny Portal, Sunny Explorer). Sunny Explorer additionally displays the corresponding event number for each event.

Inverters

Event number	Event, cause and corrective measures
102	**Grid fault/Grid overvoltage fast (102)** The line voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid. **Corrective measures:** • Check that the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
202	**Grid fault/Grid undervoltage fast (202)** The utility grid has been disconnected, the AC cable is damaged or the line voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid. **Corrective measures:** 1. Ensure that the circuit breaker is switched on. 2. Ensure that the AC cable is not damaged. 3. Ensure that the AC cable is correctly connected. 4. Check that the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.

Event number	Event, cause and corrective measures
301	**Grid fault/Voltage increase protection (301)** The line voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to comply with the power quality. **Corrective measures:** • Check that the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
401	**Grid fault/Islanding grids (401)** The inverter is no longer in grid parallel operation and has stopped feed-in operation for safety reasons. **Corrective measures:** • Check the grid connection for strong, short-term frequency variations.
501	**Grid fault/Grid frequency disturbance (501)** The power frequency is not within the permissible range. The inverter has disconnected from the utility grid. **Corrective measures:** • If possible, check the power frequency and observe how often major deviations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the grid operator approves, discuss any changes to the operating parameters with the SMA Service Line.

Event number	Event, cause and corrective measures
3401	**DC overvoltage/Overvoltage input A (SW) (3401)** The DC input voltage connected to the inverter is too high. Overvoltage at DC input. The inverter may be destroyed. **Corrective measures:** 1. Immediately disconnect the PV array from the inverter. 2. Check the DC voltage to ensure it is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC connectors to the inverter. If the DC voltage is above the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the PV array installer. If this message is repeated frequently, contact the SMA Service Line.
3501	**Insulation resistance/Insulation failure (3051)** The inverter has detected a ground fault in the PV array. As long as the fault exists, the inverter will not feed in. **Corrective measures:** • Check the PV system for ground faults (see Section 11.3).
3902	**Waiting for DC start conditions/Generator voltage too low/ Start conditions not met (3902)** Generator voltage too low. **Corrective measures:** 1. Wait for higher irradiation. 2. If necessary, remove snow or dirt from the PV modules.
3903	**Waiting for DC start conditions/Generator voltage too high/ Start conditions not met (3903)** Generator voltage too high. **Corrective measures:** • Waiting for DC start conditions.
6002 to 6006	**Self diagnosis/Interference of device (6002, 6005, 6006)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Event, cause and corrective measures
6305	**Self diagnosis/Interference of device (6305)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6402	**Self diagnosis/Overtemperature (6402)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6406	**DC overcurrent/Overcurrent input A (HW) (6406)** The current at the module input of the inverter is too high. The inverter has interrupted the feed-in operation. **Corrective measures:** • Check that the line voltage at the connection point of the inverter is permanently in the permissible range and/or whether jumps occur (e.g. by switching on and off large loads). If the line voltage is outside the permissible range due to local grid conditions or jumps occur, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
6415	**Self diagnosis/Interference of device (6415)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Event, cause and corrective measures
6450	**Self diagnosis/Energy transfer not possible/Interference of device (6450)** The inverter cannot feed into the utility grid. Possible causes: grid voltage is too high; a PV module is soiled or shaded; a cloudy or foggy day. **Corrective measures:** 1. Check that the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. 2. Check whether the DC voltage according to the datasheet of the PV module and the assessment of the weather situation is stable in a realistic range. Therefore, determine the voltage during inverter operation using a communication product. 3. Check whether the respective PV module is soiled or shaded. Clean the PV module if soiled. 4. During a cloudy or foggy day, wait for higher irradiation. 5. If none of the described causes is applicable and the message continues to be displayed, contact the SMA Service Line.
10265	**Power-line communication disrupted (10265)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Sunny Multigate

Event number	Event, cause and corrective measures
6702	**Interference of device (6702)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7001	**Fault sensor interior temperature (7001)** The sensor for the indoor temperature is defective. Feeding operations will be interrupted. **Corrective measures:** • Contact the SMA Service Line.
8001	**Derating occurred (8001)** The power of the PV system was reduced below nominal power due to a too-high temperature for more than ten minutes. **Corrective measures:** 1. To avoid yield loss and to protect hardware, ensure sufficient ventilation or operate the Sunny Multigate in a cooler place. 2. If this error also occurs at a temperature below +113°F (+45°C), contact the SMA Service Line.
8101 to 8102	**Communication disturbed (8101, 8102)** An error has occurred in the internal communication. Feed-in operation continues. **Corrective measures:** • Contact the SMA Service Line.
8104	**Interference of device (8104)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9014	**Invalid device combination (9014)** Sunny Multigate and the inverters cannot be operated in this combination. **Corrective measures:** 1. Contact the SMA Service Line and request the latest firmware package. 2. If the problem persists, the device combination is invalid. Contact the SMA Service Line.

Event number	Event, cause and corrective measures
9015	**Max. permitted number of inverters exceeded (9015)** The number of inverters connected exceeds the number specified in the currently set standard. **Corrective measures:** • Remove claimed number of inverters until the maximum permitted number is reached (see user manual of the communication product).
10221	**New device cannot be administered (10221)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
10259	**Inconsistent communication version (10259)** The communication version of the inverter is not supported. **Corrective measures:** 1. Contact the SMA Service Line and request the latest firmware package. 2. If the problem persists, the device combination is invalid. Contact the SMA Service Line.
10265	**The device with serial number X is not available for X day(s) (10265)** The communication with one or several inverters is no longer possible. **Corrective measures:** 1. Check cables and inverters for loose connectors or damages. 2. Check PV modules for soiling or damages. 3. If the problem persists, contact the SMA Service Line.
10267	**Loss of communication to one or several devices (10267)** The communication with one or several inverters is no longer possible. **Corrective measures:** 1. Check cables and inverters for loose connectors or damages. 2. Check PV modules for soiling or damages. 3. If the problem persists, contact the SMA Service Line.

11.3 Checking the PV System for Ground Faults

If the **Inverter** LED on the Sunny Multigate is glowing red, this may indicate a ground fault in the PV system. The electrical insulation between the PV system and ground is defective.

⚠ WARNING

Danger to life due to electric shock

In the event of a ground fault, high voltages can be present.

- **No** pole of the PV module must be grounded.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the framework or supports of the PV modules.
- Do not connect any PV module with a ground fault to the inverter.

NOTICE

Destruction of the multimeter due to overvoltage

- Only use multimeters with a DC input voltage range up to at least 600 V.

If the Sunny Multigate indicates a ground fault in the PV array, proceed as follows:

Procedure:

1. Ensure that **no** pole of the PV module is grounded.
2. Use Sunny Portal or Sunny Explorer to determine which of the connected inverters has a ground fault (see user manual of the communication product at www.SMA-Solar.com).
3. **⚠ DANGER**

   Danger of electric shock due to high voltages

   - Disconnect the affected inverter from any voltage sources (see Section 9).
4. Measure voltages with a suitable multimeter.
   - Measure the voltages between the positive terminal and the ground potential.
   - Measure the voltages between the negative terminal and the ground potential.
   - Measure the voltages between the positive and negative terminals.

     If the following results are returned simultaneously, there is a ground fault in the PV system.
     - All measured voltages are stable.
     - The sum of the two voltages against the ground potential is approximately equal to the voltage between the positive and negative terminals.
   - Eliminate the ground fault.

     If there is no ground fault and the problem persists, contact the SMA Service Line.
5. Commission the PV system (see Section 7 "Commissioning", page 54).

12 Decommissioning

12.1 Disassembling the Inverter

1. **⚠ DANGER**

   Danger to life due to electric shock. Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Disconnect the inverter from any voltage sources (see Section 9).

2. Release and remove all cables from the inverter.
3. Loosen all screws in the drill holes.
4. Remove the inverter from the wall or profile rail.

12.2 Uninstalling the Sunny Multigate

Additionally required tools (not included in the scope of delivery):

☐ Slotted screwdriver (blade width: 3.5 mm)

Procedure:

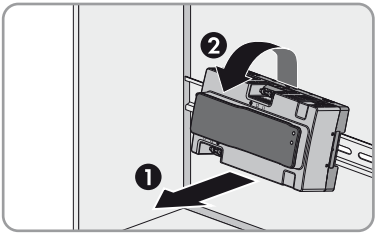
1. **⚠ DANGER**

   Danger to life due to electric shock

   - Disconnect the Sunny Multigate from voltage sources (see Section 10).

2. Release the screw terminals on the Sunny Multigate using a slotted screwdriver.
3. Remove the conductors L1 and L2 from both connecting terminal plates.
4. If connected, pull the network cable out of the pin connector.
5. Pull the grounding conductor out of both connecting terminal plates.
6. Remove the Sunny Multigate from the industrial enclosure as follows:

   - If mounted on a top-hat rail, detach the Sunny Multigate from the top-hat rail. To do this, tilt the lower edge of the Sunny Multigate forwards and lift up and off the top-hat rail.



   - If mounted using lugs, release the screws with a slotted screwdriver (blade width 3.5 mm) and remove the Sunny Multigate.

12.3 Packing the Inverter

1. Disassemble the inverter (see Section 12.1).
2. Pack the inverter, the DC connector and the AC connector. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter (see Section 13.1 "Sunny Boy 240-US", page 75).

12.4 Packing the Sunny Multigate

1. Disassemble the Sunny Multigate (see Section 12.2).
2. Pack the Sunny Multigate and the AC connector. For this purpose, use the original packaging or packaging suitable for the weight and size of the Sunny Multigate (see Section 13.1 "Sunny Boy 240-US", page 75).

12.5 Disposing of the Inverter and the Sunny Multigate

- Dispose of the inverter and the Sunny Multigate in accordance with the locally applicable disposal regulations for electronic waste.

13 Technical Data

13.1 Sunny Boy 240-US

DC Input

Maximum number of connected PV modules per inverter	1
Maximum DC power at cos φ = 1	250 W
Maximum input voltage	45 V
MPP voltage range at 240 V	23.0 V to 32.0 V
Operating range at 240 V	23.0 V to 40.0 V
Rated input voltage	29.5 V
Minimum input voltage	23.0 V
Minimum initial input voltage	23.0 V
Maximum initial input voltage	40 V
Maximum input current	8.5 A
Maximum input current per string	8.5 A
Maximum short-circuit current per module	12 A
Number of independent MPP inputs	1
Strings per MPP input	1

AC Output

Rated power at 240 V, 60 Hz	240 W
Maximum apparent AC power	240 VA
Rated grid voltage	240 V
Nominal AC voltage*	2 x 120 V
AC voltage range	211 V to 264 V
Nominal AC current at 2 x 120 V	1 A
Maximum output current	1 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%
Maximum output fault current	241 A
Maximum output duration	3.18 ms
Line synchronization characteristics	Type 2
Line synchronization in-rush current	123 mA
Rated power frequency	60 Hz

AC power frequency	60 Hz
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz
Limits of accuracy of voltage measuremet	1.2%
Limits of accuracy of frequency measurement	0.05 Hz / 0.1%
Limits of accuracy of time measurement	0.1%
Power factor at rated power	1
Feed-in phases*	2
Connection phases*	2
Overvoltage category with Sunny Multigate	IV

* 2 x 120 V split phase

Protective Devices

DC reverse-polarity protection	Short-circuit diode
Grid Monitoring	SMA Grid Guard
AC short circuit protection	Available
Ground-fault monitoring	Insulation monitoring: R_{iso} > 1 MΩ
Galvanic isolation	Available

General Data

Width x height x depth, without connection area	$7\,^{13}/_{32}$ in. x $7\,^{53}/_{64}$ in. x $1\,^{45}/_{64}$ in. (188 mm x 199 mm x 43 mm)
Width x height x depth, with connection area	$7\,^{13}/_{32}$ in. x $8\,^{37}/_{64}$ in. x $1\,^{45}/_{64}$ in. (188 mm x 218 mm x 43 mm)
Weight	2 lbs 13 oz. (1.3 kg)
Operating temperature range	– 40°F to +149°F (– 40°C to +65°C)
Storage temperature	– 40°F to +158°F (– 40°C to +70°C)
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	9,840 ft. (3,000 m)
Noise emission (typical)	≤ 38 dB(A)
Power loss in night mode	< 0.3 W
Topology	HF transformer
Cooling concept	Convection
Enclosure type rating in accordance with UL50	Type 3R
Protection class	I

Approvals and national standards, as per 05/2013	UL1741, UL1998, IEEE 1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 No. 107.1-1

Features

DC Connection	DC plug with DC connector* : DC plug, assembled, MC3 (US), DC plug, assembled, MC4 (US), DC plug, assembled, Tyco (US)
AC connection	AC cable with two connectors**
Powerline interface	As standard

* The DC connectors supplied depend on the order (for SMA order numbers of the DC connectors (see Section 14 "Accessories", page 80)).

** The length of the AC cable depends on the order and is either 4 $^{19}/_{32}$ ft. (1.40 m) or 6 $^{9}/_{16}$ ft. (2.0 m).

Torques

Grounding bolt	31 in-lb (3.5 Nm)

Grid Configurations

Split phase	Suitable
Autotransformer*	Limited suitability

* When using autotransformers, take into account that the voltages of L1 to the grounding conductor and L2 to the grounding conductor are symmetrical in no-load operation and under load within the permissible range, otherwise the PV system cannot be operated on the transformer. If the voltages L1 to grounding conductor and L2 to grounding conductor are not symmetrical within the permissible range, the device will not be damaged.

Efficiency

Maximum efficiency, η_{max}	95.9%
CEC efficiency, η_{CEC}	96.0%

13.2 Sunny Multigate-US

AC Input

Maximum number of connected micro inverters	12
Minimum number of connected micro inverters	1
Maximum input current	12 A

AC Output

Rated power at 240 V, 60 Hz	2,880 W
Rated grid voltage	240 V
Nominal AC voltage*	2 x 120 V
AC voltage range	211 V to 264 V
Nominal AC current at 240 V	12 A
Maximum output current	12 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%
Rated power frequency	60 Hz
AC power frequency	60 Hz
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz
Power factor at rated power	1
Feed-in phases*	2
Connection phases*	2
Overvoltage category	IV

* 2 x 120 V split phase

Protective Devices

Overvoltage protection	Varistors
Maximum permissible fuse protection	15 A

General Data

Width x height x depth	6 $\frac{3}{8}$ in. x 3 $\frac{1}{2}$ in. x 2 $\frac{1}{2}$ in. (162 mm x 90 mm x 63 mm)
Weight	1 $\frac{1}{2}$ lbs (0.7 kg)
Operating temperature range	– 40°F to +113°F (– 40°C to +45°C)
Storage temperatur	– 40°F to +158°F (– 40°C to +70°C)
Maximum permissible value for relative humidity, non-condensing	100%

Maximum operating altitude above MSL	9,840 ft. (3,000 m)
Cooling concept	Convection
Industrial enclosure for indoor use: Enclosure type rating in accordance with UL50E	Type 1
Industrial enclosure for outdoor use: Enclosure type rating in accordance with UL50E	Type 3
Protection class	I
Pollution degree	3
Approvals and country standards, in accordance with 05/2013	UL1741, IEEE 1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 No. 107.1-1

Features

Power-line communication to inverters	As standard
Speedwire/Webconnect communication to SMA communication products, RJ45	As standard
Display of the PV system and communication status	2 LEDs

Torques

Screw terminals	5.31 in-lb (0.6 Nm)

Data Storage Capacity

Energy yield over the day per inverter	At least 63 days
Daily yields per inverter	At least 30 years
Event messages of the Sunny Multigate for users	At least 1,024 events
Event messages of the Sunny Multigate for installers	At least 1,024 events
Event messages per inverter for users	At least 256 events
Event messages per inverter for installers	At least 256 events

13.3 Torques of AC Field Plug

Screw in insulator	7 in-lb (0.8 Nm)
Nut of AC plug enclosure (initial torque)	29.2 in-lb (3.3 Nm)
Nut of AC plug enclosure (end torque)	45.1 in-lb (5.1 Nm)

14 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, these can be ordered from SMA or your distributor.

Designation	Brief description	SMA order number
DC plug, assembled, MC3 (US),	DC plug, assembled, Multi-Contact KST3 Multi-Contact USA, type PV-KST3II-UR (male)/type PV-KBT3II-UR (female), AWG 14, maximum rated 600 V DC, 20 A DC.	MI-DCM3-US-10
DC plug, assembled, MC4 (US),	DC plug, assembled, Multi-Contact KST4 Multi-Contact USA, type KST4/2.5II-UR (male)/type PV-KBT4/2.5II-UR (female), AWG 14, maximum rated 600 V DC, 30 A DC	MI-DCM4-US-10
DC plug, assembled, Tyco (US)	DC plug assembled with Tyco Solarlock Tyco Electronics AMP GmbH, type 1394461 (male)/type 1394462 (female), AWG 14, rated maximum 600 V DC, 25 A DC	MI-DCTYCO-US-10
AC field plug (US)	AC field plug	ACCON-US-10
AC protective cap	AC protective cap	MI-ACCAP-US-10
Industrial enclosure complying with UL50E for indoor and outdoor installation of the Sunny Multigate	Industrial enclosure complying with UL50E, enclosure type rating 3	Multigate XT-0
AC cable $4^{19}/_{32}$ ft. (1.40 m)	AC cable for connection to inverter	MI-ACCAB14-US-10
AC cable 6 ft. (2.0 m)	AC cable for connection to inverter	MI-ACCAB20-US-10
Cable for AC field plug in accordance with UL6703	UL listed with +194°F (+90°C) wet/dry rating, approval (UL 184) Manufacturer: LAPP USA	Lapp–Tray Cable II A 3G AWG14/46 BK cULus Listed QPOR TC-ER cable
Bootlace ferrules AWG 14 (UL-listed)	Manufacturer: Miromar LLC	Distributor: Ferrules Direct Order no. N25010

Designation	Brief description	SMA order number
Cable shears	Insulated handles, $6\frac{1}{2}$ in. (165 mm) Manufacturer: KNIPEX	via distributor Art. no. 95 16 165
Stripping knife with straight knife blade	TiN $\frac{5}{16}$ in. to 1 $\frac{7}{64}$ in. (8 mm to 28 mm) Manufacturer: JOKARI	via distributor Art. no. 728000
Insulation stripping tool	Stripping diameter up to AWG 7 (10 mm²), stripping length up to 1 in. (25 mm) Manufacturer: WEIDMÜLLER	via distributor Order no. 9005000000
Crimping tool	Square crimping tool for bootlace ferrules, up to AWG 7 (10 mm²) Manufacturer: RENNSTEIG	via distributor Art. no. 610 084 3
Torque screwdriver	1.4" hexagon socket, 2.7 in-lb to 10.6 in-lb (0.3 Nm to 1.2 Nm) Manufacturer: WERA	via distributor Art. no. 05074700001
Bit	1.4" hexagon socket, Length: 1 in. (25 mm) Application: cross-head screws Manufacturer: WERA	via distributor Art. no. 05056422001
torque wrench	Adjustable by scale, torque range: 17.7 in-lb to 177 in-lb (2 Nm to 20 Nm) Manufacturer: STAHLVILLE	via distributor Art. no. 50181002
Crow's foot wrench, AF 25	Manufacturer: STAHLVILLE	via distributor Art. no. 02190025
Square insertion tool	Outer square: $\frac{3}{8}$ in. Inner square: 9x12 Manufacturer: STAHLVILLE	via distributor Art.-No. 58240005 (734/5)
Screwdriver	Insulated, Blade width: $\frac{5}{32}$ in. (4 mm) Blade thickness: $\frac{1}{32}$ in. (0.8 mm) Manufacturer: WERA	via distributor Art. no. 05006115006

15 Compliance Information

FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes or modifications not expressly approved by SMA America, LLC could void the user's authority to operate this equipment.

IC Compliance

This device complies with Industry of Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause interference, and
- This device must accept any interference, including interferences that may cause undesired operation of the device.

16 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Type of inverter
- Type of Sunny Multigate
- Type and number of modules connected
- Communication method
- Fault or Error

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Canada/ Canadá	SMA Canada, Inc. Toronto	+1 877-MY-SMATech (+1 877-697-6283)***

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